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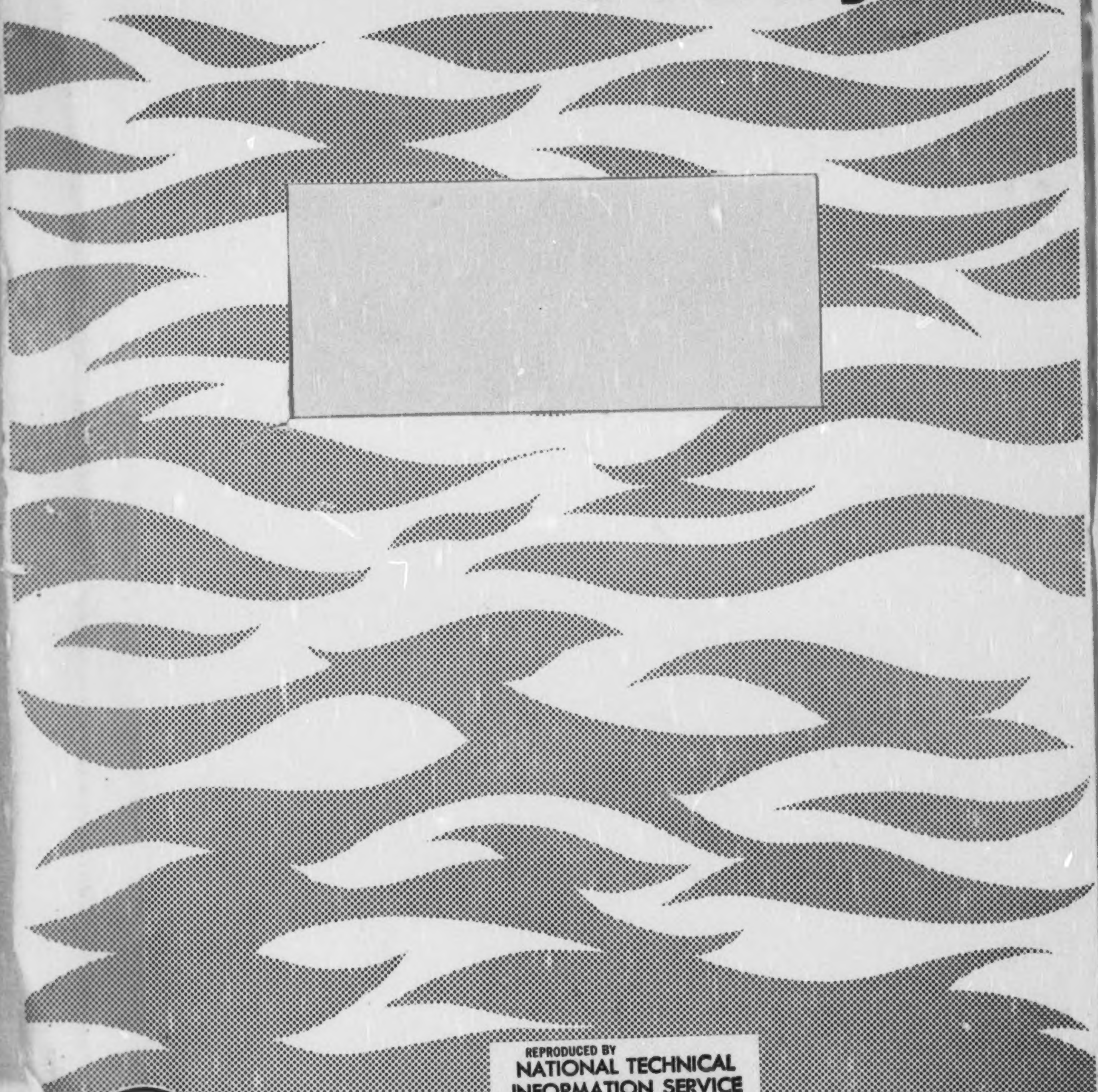

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Potential recreation benefits that may accrue to the region from various alternative rates of improvement of the waters of the Delaware River were examined, defined, and measured. The area of immediate concern includes 11 counties on both sides of the river. While a number of factors were identified as they affect the four recreational activities under consideration (swimming, boating, fishing, and picnicing), only a few were found to be relatively important. These are income, leisure time, proximity of facilities, and age. Each of these were projected and the resulting changes were related to the extent of participation in the recreation activities. An increase in rate of participation was projected.

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WATER-ORIENTED RECREATION BENEFITS

A Study
of the Recreation Benefits Derivable from Various Levels of Water Quality of the Delaware River

PHASE I

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PREFACE

The research work of the project has been financed by the Public Health Service, Department of Health, Education, and Welfare under contract No. PH 86-65-74. This report covers only Phase I of the research.

The work was carried out within the Institute for Environmental Studies, University of Pennsylvania, under the direction of Dr. Anthony R. Tomazinis, Project Director, and Iskandar Gabbour, Research Associate. Several graduate students of the University of Pennsylvania have contributed to the work of the project as research assistants. Among them are Daniel Brodsky, William C. Wheaton, Michael Hallor, Dhody Dinesh, and Judith Bronstein. Programming assistance was rendered by Colin Wordley, Research Associate at the Institute. Mrs. Mary Ellison, Mrs. Doris Smith and Mrs. Janice Ludman have carried most of the typing load of the project.

CHAPTER I

INTRODUCTION

The objective of the study presented in this report is to discover, define and measure the identifiable potential recreation benefits which may accrue to the region from various alternative rates of improvement of the waters of the Delaware River. The part of the river included in this study was the one bounded by a point just south of Trenton, New Jersyy to Liston Point, which is just north of the southern and of New Castle County, Delaware. The area that was of immediate concern to this study is shown in Figure 1 and includes eleven counties on both sides of the Delaware River.* Improvements taken into account in this study consist of, essentially, reasonable restorations of the quality of the river's water to different levels of its natural condition, prior to man-made pollution.

This study is part of a larger project, usually referred to as the Delaware Estuary Comprehensive Study (DECS). The role, which the present study is intended to perform as part of the more extensive project, is the provision of an estimate of the benefits (especially recreation benefits) which may be expected as a result of each alternative cost outlay that is associated with the different plans of river purification. In this respect the objectives of the present study are quite specific and limited, since

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* The included counties are: New Castle, in the State of Delaware; Burlington, Camden, Gloucester, Hunterdon, Mercer and Salem, in the State of New Jersey; and Bucks, Chester, Delaware, Montgomery, and Philadelphia, in the State of Pennsylvania.

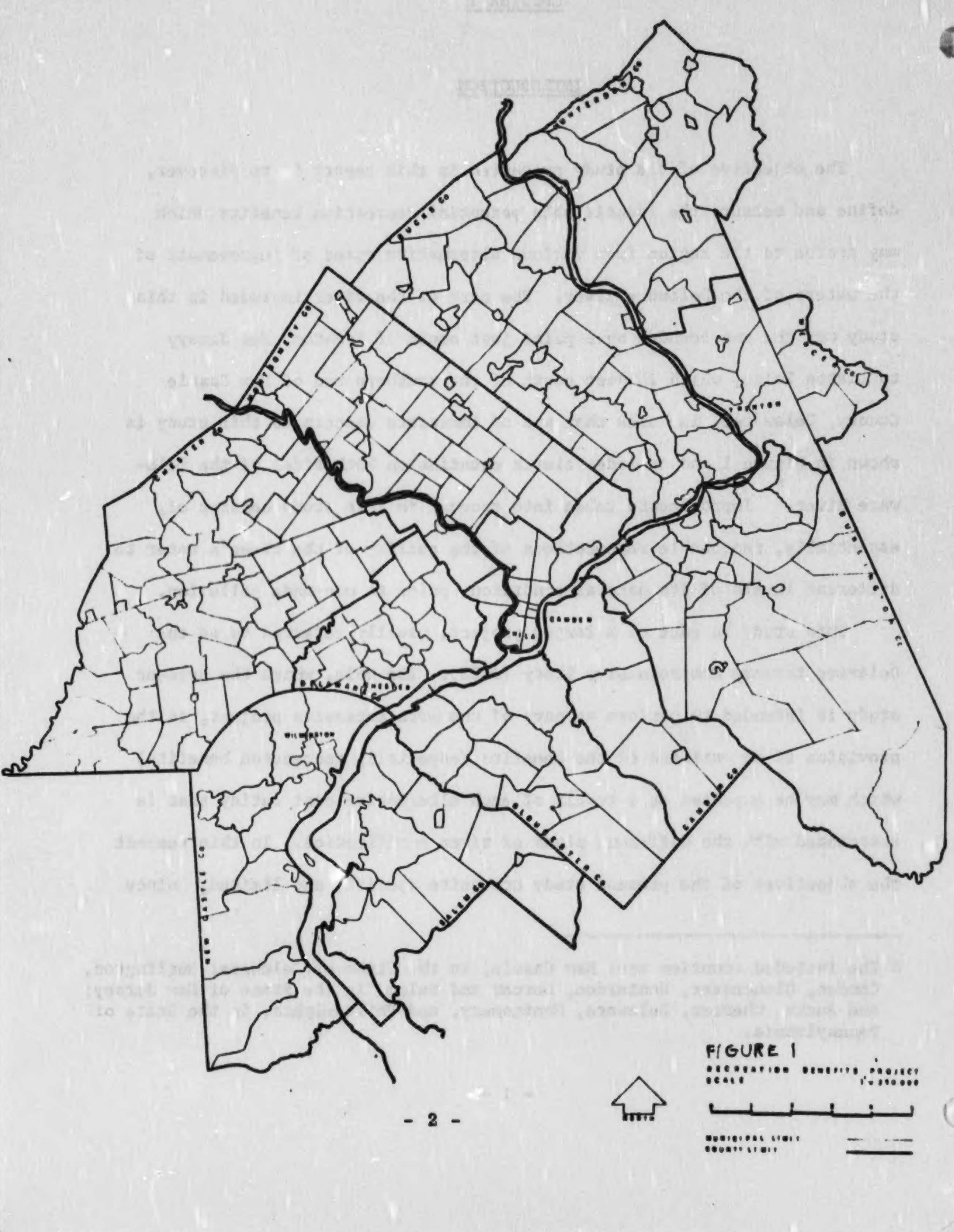

WILMINGTON
CAMDEN CO
RECREATION BENEFITS PROJECT
SCALE
NORTH
MUNICIPAL LIMIT
COUNTY LIMIT

FIGURE 1

the work reported here is designed to meet certain, specific needs of the present research effort.

The whole effort of defining, investigating and projecting the derivable recreational benefits has been divided into two parts, termed Phase I and Phase II of the whole effort. The present report presents only Phase I of the undertaking. This phase includes essentially two sections; the determination of the projection relationships, and the determination and projection of the competitive or supplementary outdoor recreation facilities within the region. Phase II includes the actual projection of recreation beneftis for the years 1976 and 2000.

The subject matter of the present project has certain characteristics which appear to be of particular current interest. For instance, the primary feature of the objective of this project is that it focusses on recreation needs *within* a metropolitan region, and particularly on outdoor *water-oriented* recreation needs. These characteristics bear some important ramifications. For example, the question of providing sufficient outdoor water-oriented recreation facilities within a metropolitan region is closely associated with, among others, the problems of uncovering and estimating both the manifest and the latent demand for such facilities and services within the metropolitan region. In essence, the problem centers on how to include in the recreation demand projection process the influence of those factors which usual supra-region data and park-users data either do not include, or minimize their significance. Thus any emphasis on primarily manifest recreation demand and on its variations, would ostensibly minimize the significance of such factors as relatively excessive or prohibitive user costs, distance between the facilities and potential users, lack of familiarity with recreational areas, and a general lack of information about recreation services, or, on occasion, the significance of an effective or actually non-existance of facilities. A study of water-oriented outdoor recreation demand within a metropolitan region should, seemingly, take into account such factors, as well as several others which cause the existance of latent demand. The scale and the particularities of a metropolitan region frequently transform many of these factors from marginal influences into primary forces determining outdoor recreation demand within the metropolitan region. It is for that reason that latent demand consideration must be included in studying the potential impact that improved water quality in the Delaware River might have within the region.

In addition to the "locational" characteristic of the present study, its objective of determining demand for water-oriented recreation facilities appears to be of particular current interest. The recent upsurge of concern about limited water resources (especially in the urbanized regions of the country) has been a current topic and any research on the effects of improving the quality of a major water resource within a metropolitan region can easily be seen as being only a part of the general water resources problem. Social planners, as well as those concerned with the water supply problems, may also find the study of some interest. Finally, the social significance of the availability of water-oriented outdoor recreation facilities within or near areas of social and economic "relative deprivation" has recently been re-emphasized, particularly since recent public disturbances have increased the pressure to supply such facilities considerably.

In carrying out the present study, certain limitations had to be recognized at the outset of the undertaking. A major limitation was that the available funds and time schedule did not permit the collection of extensive new and ad hoc data within the region. An attempt to acquire and analyze original and detailed data from the Detroit Metropolitan Area has also proven fruitless because of data deficiencies. Also, the fact that the objective of the study was a specific one, tailored to meet the needs of the parent study of the Delaware Estuary should be considered as a definite limitation in objectives and methods of the present study. In that respect, the present project could neither afford to test some of the basic hypotheses with original data, nor expand its scope to cover a major part of the whole field of outdoor recreation demand, let alone to raise and discuss the utility and optimality concepts of this demand within metropolitan regions.

In spite of these limitations and the fact that previous research work on the subject has been meager, and scantily reported, the present project has constantly attempted to meet its objectives within the appropriate framework of scientific inquiry and empirical verification. Data from the Philadelphia Metropolitan Region, the T.V.A. and the Detroit Metropolitan Area were the primary sources. The ORRRC reports as well as several other state, county and city reports from various parts of the country were heavily drawn upon in search and verification of the suspected relationships. Data from the Penn-Jersey Transportation Study, as well as several other regional agencies, were used for the 1976 and 2000 population projections.

In general, the work followed a deductive approach which permitted the research staff to follow a sequence from the general to the particular.

This succession of analysis is partially indicated by the sequence of chapters in this report. An examination of the overall problem of recreation demand projections is followed by the presentation of the general model which served as the guide for the remaining work. Present conditions are presented in Chapter IV while prevailing demand relationships follow in Chapter V. The projection of future relationships and trends are discussed in Chapter VI. In Phase II of the project, the regional future water-oriented recreational demand will be compared with the capacity of proposed projects, within and without the region, and also with the capacity of each of the alternative solutions proposed for developing the Delaware River. On the basis of this comparison, the recreation benefits from improving the river's waters will be estimated. Finally, these benefits will be expressed in a form of a range of monetary values so that some cost benefits analyses of the alternatives may be rendered feasible. This part of the project is presented in the report of Phase II. The present report ends with some general conclusions and ramifications of the findings of the work carried out during Phase I of the project.

CHAPTER II

THE PROBLEM AND ITS THEORETICAL FRAMEWORK

The essential objective of the work described in this report is the determination of the recreation benefits which might appear in the Delaware River region at some future time as a result of one or another set of actions taken to improve (or restore) the water quality of the river. This objective, while it may appear simple as stated above, actually reflects a complex problem and required a careful and comprehensive examination of several major issues. In fact, the initial task may well be considered to be the formulation of the theoretical framework of the entire effort, before the entire analysis may be determined and carried out.

Underlying this concern for recreation benefits is, or course, the general belief in our society that recreation, in general, and outdoor recreation in particular, is beneficial to the welfare of the people, and that an increase in the present level of recreation activities (and corresponding facilities) in the foreseeable future is desirable from both the individual and societal points of view. Thus, the estimation of recreation benefits as part of a water improvement river project is based on this fundamental proposition that outdoor recreation activities are highly esteemed and appreciated in our society. What are these recreation benefits? The concept of recreation benefits is an elusive one, especially when the analyst seeks a strict definition that is both exhaustive and operational. Recreation is still a very subjective phenomenon. What one person regards as relaxing may well be viewed as a chore by another. Frequently, it is the form that a recreation activity takes, and the intensity with which it is undertaken, that are debatable. At present, what is needed to make the concept of recreation (and of its benefits) more amenable to precise analysis is an aggregate valuation of forms and patterns of recreation associated with society's goals for recreation. Without a clear definition of such goals no real evaluation of recreation plans and benefits can satisfactorily be carried out.

The problem of definition becomes more complex when recreation benefits are considered as a whole. The concept of benefits may be expressed in as precise a configuration as dollars and cents or as subjective a notion as aesthetic pleasure. In fact, there is not only a range of sources for recreation, but also a host of components which determine the extent and intensity of benefits derived from recreational activity.

This report is specifically concerned with outdoor water-oriented recreation activities centered around the Delaware River. An all-inclusive inventory of potential recreation would contain many activities such as boating, swimming, fishing, picnicking along the river's edge, and nature walks near the banks of the river. The benefits gained from the improvement of the water quality for these activities would vary from pleasure, educational and athletic achievements derived by the participants, to perhaps cleaner and fresher air freed of noxious odors, for those using the facilities, residents of nearby neighborhoods, and those engaged in other activities in the urban area. In other words, the specific interests of this study of water-oriented activities and how they can be changed, can be considered, from one point of view, as broad and wideranging as the notion of recreation benefits itself.

However, in order to obtain a more quantifiable picture of potential recreation benefits the present study will only focus on four specifically defined activities (swimming, boating, fishing and picnicking) and will not attempt to specify benefits derivable from other aspects of river-oriented activity, such as nature walks, aesthetic enjoyment, and cleaner air. One way to estimate the potential recreational benefits derivable from improvements in the water quality of the Delaware River, especially as it affects the four sports mentioned above, is to look at the extent of the present and future activities. The desire to undertake recreational activities is usually what is meant by recreation demand. In defining and measuring this recreation demand, several intermediate steps are required. For the purposes of this study the emphasis is placed on determining the extent of the desire to undertake outdoor water-oriented recreation activities by the residents of the Estuary Region and neighboring areas for each activity separately.

In measuring the desire, and conversely, the demand for a particular recreation activity, one faces several problems. In essence, any measurement of present demand must start from measuring the manifest demand; that is, the expressed demand must first be measured and then related to appropriate indices which may express some of the primary forces that influence the extent of what is referred to in this report as manifest demand. This manifest demand needs also to be related to future populations that may be exercising this demand. This procedure, although complicated and difficult, is part of what a comprehensive projective effort entails. However, in addition to measuring the present manifest demand, one may expect the existence of some additional desire to recreational activities which is, at present, constrained. Such unexpressed desire is frequently termed the present latent demand for recreational activities. Obviously, for projective purposes, one may properly take the present-day latent demand into account and project its size for any given time in the future.

The sum manifest and latent demands make up the total present-day recreation demand in a given area for a given activity. While this, in principle is the appropriate basis for recreation demand estimations, most planning efforts are concerned with several additional aspects of the problem. One of these aspects is the expectation that manifest demand rates and relationships may vary significantly and concurrently with major shifts in the size, and in the type of present-day latent demand measures. Another aspect of the problem is the definition and determination of that part of the total demand, for one or a group of activities, which comprise what may be termed the "design demand." Usually the design demand for a service is considered to be that proportion of the total demand for that service, which is both certain to be experienced consistently and frequently enough and is feasibly provided for within the given circumstances.

The analysis and projection of future recreation demand for certain regions has been the subject of several pertinent studies. Appendix A of this report presents several of the significant approaches followed in these studies. In general on may notice that these previous efforts may be categorized by either conceptual discussions and solutions to the problem of projecting future demand, or by ad hoc, and pragmatic approaches designed to solve the problem in a specific area under well-defined circumstances. The reviewer may also notice that in the great majority of cases, the projection of future recreation demand is primarily based on relationships relevant mainly to present-day manifest demand. Only in a few instances are the considerations pertinent to latent demand taken into account, notably in those studies undertaken at the University of Pennsylvania's Group for Economic Research and Institute for Environmental Studies.

In most cases of recreation demand projection, the analysts are primarily interested in determining the potential demand for a proposed facility. In this respect, any factor which has been found to be related to the size of the demand (e.g., distance from the facility) is taken into account in terms of its restrictive capacity. Thus, the demand estimations proposed are based on what the given set of circumstances are expected to produce. This approach is a "market-oriented" one, strongly influenced by the principles and methods of economics. Only on rare occasions will a planning analyst find any concern expressed for demand estimations which denote the unrestrained total demand for recreation facilities and activities. Such an approach would obviously focus, not on the restrictive characteristics of a given set of influential factors, but on the potential combinations and variations of these factors for permitting the manifestation of the entire recreation demand as it may occur before any factors, exogenous to the individual, have been allowed to enter the analysis. Estimating recreation demand in this way would permit the planning analyst to specify the demand which may occur under a certain set of circumstances, and also the demand which may be left unexpressed and consequently go unsatisfied.

Although the distinction between manifest and latent demand may appear blurred in these cases, one should also notice that for the purposes of planning alternative systems of recreation facilities, one needs to know both the expected demand on each system of recreation facilities as well as the unsatisfied demand remaining in each case. Knetsch (i) and Davis (ii) appear to be among the first to approach this problem of alternative demand estimations, but the "Open Space Study" (v) and the cost-benefit of Davidson-Adams-Seneca (vi) of the University of Pennsylvania seems to provide some means of facing the problem in pragmatic terms. (See Appendix A).

In spite of those previous contributions to the theory and practice of projection outdoor recreation demand, the problem remains largely unexplored. Partly for this reason and partly due to the special problems posed by each recreation study until now, the alternative projections of outdoor recreation demand on an actual study basis have always been characterized by ad hoc solutions and methodology. In theory, three steps are required to determine alternative future outdoor recreation demand. First, one must carry forward the relationships which determine present-day manifest demand. Secondly, one must identify the extent to which present-day latent demand exists; then, one must carry forward the relationships which may depict both the future manifest and latent demand.

Relationships expressing the various influences on present-day demand are instrumental in projecting the future demand which may correspond to the present manifest demand. The same relationships also help to take into account and project part of the present-day latent demand.

Relationships expressing the various influences on present-day demand are instrumental in projecting the future demand which may correspond to the present manifest demand. The same relationships also help to take into account and project part of the present-day latent demand. This refers to the part of latent demand which is dormant primarily due to user-oriented constraints. For instance, presently restricted outdoor recreation demand due to the income limitations of a population group makes up part of the present-day latent demand. Major shifts in income in the future may result in at least a partial removal of restrictions previously applicable to recreation demand. Thus, the same relationship which at a given period expressed only the manifest recreation demand for that period can also be seen as being basically able to express the future probable manifest demand (which includes part of the newly emerged manifest demand).

The identification and the measurement of the latent demand at a given instance is the second step in the process, but a step that is quite frequently overlooked. Recreation has often been viewed as a commodity of a highly elastic demand. This demand elasticity is responsive to cost and income variations and also to several other factors affecting the preference of the user as well as the circumstances in which a recreation activity is to be undertaken. In a study where the major objective would be the provision of facilities commensurate to a given level of demand, any concern with the latent demand in each case would essentially have been irrelevant. However, for the purposes of our present study, the consideration of the latent demand is directly relevant. Outdoor recreation demand which may be thought of as intrinsically in existence may not manifest itself for at least three major reasons: lack of available facilities, lack of sufficient acquaintance with available facilities, and cost and income limitations.

It is interesting to notice that all three major causes of the latent demand are interrelated and have been discussed by several researchers in the past. The Clawson and the Davidson-Adams-Seneca studies have already mentioned the factors of "learning-by-doing" and "facility inducement." However, among these three major factors only the one of cost and income elasticity of recreation demand has been frequently discussed. In fact, even the method of "mean park distance" of the "Open Space Project" of the University of Pennsylvania can be seen as essentially a measure of the cost associated with participation in recreation activities in the parks of the region.

As stated earlier, recreation benefits due to improvements in the water quality of the Delaware River include the nature walks and aesthetic pleasures of observing the river, as well as the associated improvements of residential areas along the river. While the conceptual place of these three additional types of benefits is not in doubt, there seldom has been any quantitatively stated measurement of these benefits. For this reason the present study does not include any specific estimates of such benefits. However, the appreciation of the significance of these three other types of benefits should always be kept in mind and considered in addition to the quantifiable benefits of the four types of recreational activities studied here.

CHAPTER III

A PROJECTION MODEL

The projection of recreation benefits which the region may reap from improving the water quality of the Delaware River is obviously an undertaking which necessitates several considerations. In fact, it appears that benefits derivable from each of the activities under study can be determined by an operation which must pass through at least four distinct stages of analysis and consideration.

The initial step may take the form of projecting the total demand for a given activity in a region. This analysis and projection includes both the manifest and the latent demand for that activity. In both types of demand, the analyst's attention should focus on the frequency with which a recreation activity is desired as well as on the number of people who participate. Factors or variables which affect the demand today should also be thoroughly explored and projected for the future. The effect of the availability of the new facilities should be taken into account at this point in the analysis. Then, by using the proper relationships (sub-models) one can reach an estimate of the total demand for an activity in a specified region at a given time. It may be that annual estimates are appropriate together with sufficient information on both the seasonal and daily distribution of the usage of facilities: the sources, then, of the design demand for each recreation activity may become apparent.

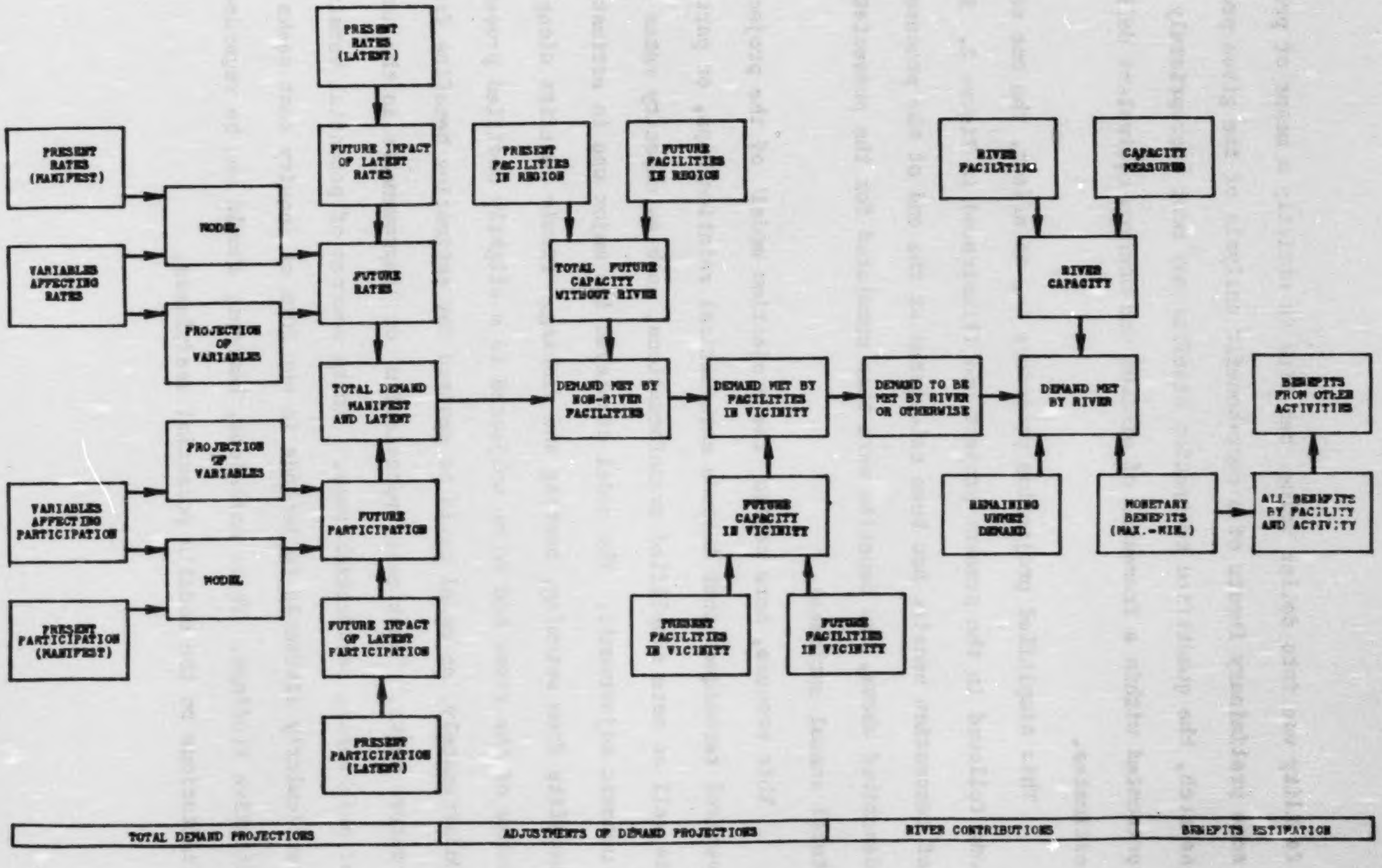
The second phase of analysis and projection may take the form of an adjustment of the previously derived total demand in order to take into account the capacity and availability of the recreation facilities that have already been planned and projected in the region and its vicinity. Obviously, the total demand, even when it is broken down by annual, daily and seasonal components, is not the effective demand which must be considered, when the potential contribution of a particular new project is evaluated. The contributions offered by other facilities which are either already on the drawing board or being designed for meeting part of the total demand should be incorporated in the initial steps of a projection in order to avoid conflicts later on and, perhaps, double counting. Furthermore, other pertinent facilities within the region as well as in its vicinity (in what may be called "service areas" in the region) should also be considered.

At this point, the analysis may directly focus on the contributions of the new project under consideration. In our case, this refers to the additional benefits that the river may offer due to its improved water quality. The new project must be examined with regard to at least three dimensions: its location must be ascertained; its capacity must be designated; and the specific activities that the project makes possible should be determined. At the end of this phase, any potential demand which remains unsatisfied as well as any capacity of the new facility that goes unused become apparent and can be estimated.

The estimates which have been obtained during stage three are then utilized in the final stage of a project requiring quantification of recreation benefits. The planner here may attempt to translate the quantitative estimates of recreation activities into some reasonable dollar equivalent and rename it as recreation benefits. Such a transformation of

FIGURE 2

THE PROJECTION MODEL


PRESENT RATES (LATENT)
PRESENT RATES (MANIFEST)
MODEL
FUTURE IMPACT OF LATENT RATES
VARIABLES AFFECTING RATES
FUTURE RATES
PROJECTION OF VARIABLES
TOTAL DEMAND MANIFEST AND LATENT
PROJECTION OF VARIABLES
VARIABLES AFFECTING PARTICIPATION
FUTURE PARTICIPATION
MODEL
PRESENT PARTICIPATION (MANIFEST)
FUTURE IMPACT OF LATENT PARTICIPATION
PRESENT PARTICIPATION (LATENT)
PRESENT FACILITIES IN REGION
FUTURE FACILITIES IN REGION
TOTAL FUTURE CAPACITY WITHOUT RIVER
DEMAND MET BY NON-RIVER FACILITIES
DEMAND MET BY FACILITIES IN VICINITY
FUTURE CAPACITY IN VICINITY
PRESENT FACILITIES IN VICINITY
FUTURE FACILITIES IN VICINITY
DEMAND TO BE MET BY RIVER OR OTHERWISE
RIVER FACILITIES
CAPACITY MEASURES
RIVER CAPACITY
DEMAND MET BY RIVER
REMAINING UNMET DEMAND
MONETARY BENEFITS (MAX.-MIN.)
BENEFITS FROM OTHER ACTIVITIES
ALL BENEFITS BY FACILITY AND ACTIVITY
TOTAL DEMAND PROJECTIONS
ADJUSTMENTS OF DEMAND PROJECTIONS
RIVER CONTRIBUTIONS
BENEFITS ESTIMATION

facility use into dollar value benefits is strictly a means of providing some preliminary inputs of a cost-benefit analysis of the given project. As such, the quantified recreation benefits may most appropriately be presented within a framework of minimum and maximum equivalent dollar estimates.

This simplified projection procedure is, in effect, the one selected and followed in the present project and illustrated in Figure 2. Each type of recreation benefit has been calculated at the end of the process described above, and benefits were then cumulated for the presentation of total annual estimates.

This process, here called "the projection model" of the project, involves several techniques that include mathematical relationships, or partial models, as well as more simplified transformations, such as capacity rates and socio-economic adjustments. The model displayed its major use in estimating benefits from swimming, boating and fishing. Picnic benefits along the banks of the river had to be subjected to a slightly modified process. Unfortunately, no model could be devised for estimating benefits from "nature walks," "aesthetic appreciation" or "improvements in the atmosphere of neighboring residential areas." These sources of potential benefits are particularly difficult to include in any form of inquiry that seeks quantitative findings. These omissions, however, should not be regarded as limitations on the model's potential usefulness.

CHAPTER IV

EXISTING CONDITIONS

An examination of the existing conditions of the water-oriented recreation activities in the study area may reveal where areas with a sizable water acreage are located. Emphasis on the river water-oriented recreation activities under consideration (swimming, boating, and fishing) may also reveal their location concentration in only a few parts of the region.

Figure 3 shows graphically the availability and size of the major bodies of water in the study area. Appendix C lists their location and acreage. In the study area, there is available 2,524 acres of water in the State of Delaware, mainly concentrated in the Chesapeake and Delaware Canal (2,000 acres); 7,752 acres in New Jersey, with three major concentrations in the following: Fort Dix Reservation in Burlington County (2,000 acres), Round Valley State Park in Hunterdon County (2,255 acres undeveloped), and Cooper River Park area in Camden County (1,680 acres). Among these three areas, Cooper River Park area is by far the most intensively used. This area, in fact, consists of a series of six parks running on either or both sides of Cooper River. These are Farnam Park, Camden Park, Cooper River Park, Pennypack and Hopkins Park, Wallworth and Evans Park, and Mountwell Park. In Pennsylvania, only 2,476 acres of water are available with about 1,230 acres located in French Creek Park area; the rest has no specific locational concentration. About 379 water acres of the Schuylkill River are included in Fairmount Park, while Wissahickon Park includes most of Wissahickon Creek.

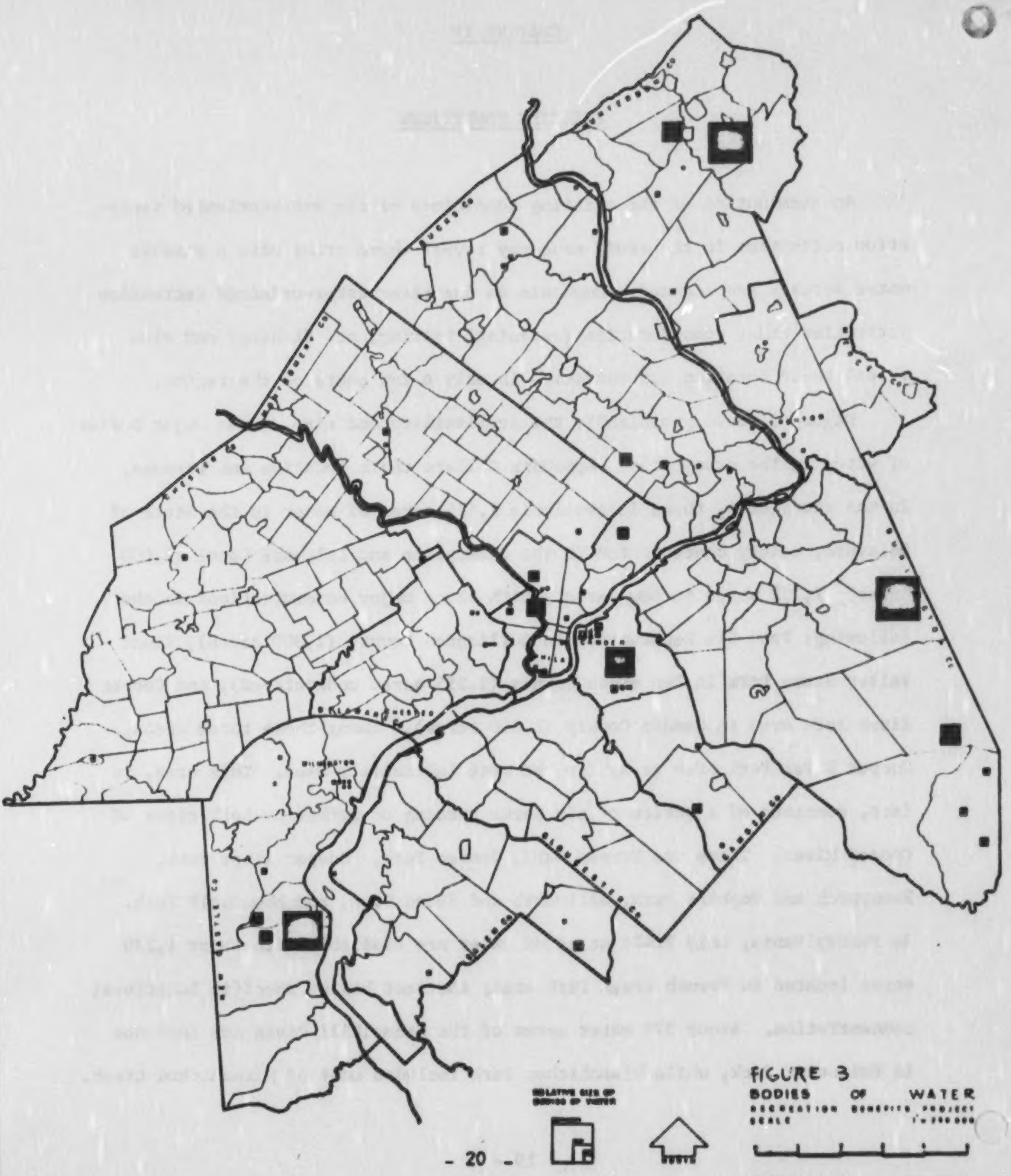

WILMINGTON
RELATIVE SIZE OF BODIES OF WATER
NORTH
RECREATION BENEFITS PROJECT
SCALE
MUNICIPAL LIMIT
COUNTY LIMIT

FIGURE 3
BODIES OF WATER

The use of these waters for recreational purposes is, however, minimal. Swimming is only possible in Gustine Lake in East Fairmount Park, while there is boating and fishing at Concourse Lake, in West Fairmount Park and in some sections of Wissahickon Creek. Picnicking, on the other hand, is quite an intensive activity in both these parks.

The total available water acreage in the study area is, then, close to 11,620 acres. These are all the waters, developed or underdeveloped (with or without facilities). For the Delaware River itself, about 45,000 acres of available water is estimated. Outside of, but in proximity to the study area, there is the Delaware Bay, with about 560,000 acres of water. Further away is the New Jersey shore (extending for two miles and including bays, lagoons, etc.) with approximately 250,000 water-acres.

Potential recreation areas to be developed in conjunction with major bodies of water are not numerous. They include Christiana Reservoir in New Castle County, with about 2,900 acres of water. In Pennsylvania, four areas of potential development have been identified. They total about 6,000 acres of water. These are Newton, Evansburg, and Newark Reservoirs, and Tohickon Creek. While the development of the Tocks Island project would substantially contribute to the water acreage in the region, it is located outside of the study area and its use would necessitate some travel inconvenience.

Developed waters are generally of two types: large, usually salt water areas (such as the shore and bay); and smaller, inland, fresh water areas. The larger, salt water areas have, in general, much more potential for physical considerations than the smaller fresh water areas. In addition, fresh water areas are usually fairly well developed, and leave little room for expansion. The alternative, then, lies in the development of new areas.

The inclusion of the Delaware River (by water purification) in the system of developed inland fresh water areas would contribute quite substantially to the total inland water available for recreational activity. Several conclusions in terms of water supply can, hence, be drawn:

a. The water acreage available in the study areas for recreation in general and for boating in particular is minimal. Delaware Bay and the New Jersey shore (salt water) are the closest areas used for such purposes.

b. The development of the shore and bay is quite small. There is much water yet to be developed for recreation there.

c. Most of the inland fresh waters in the areas are fully developed, but still represent only a small proportion of total water areas.

d. The Delaware River is, by far, the largest potential source for the increase in inland water available for recreation. The other sources being proposed are a number of reservoirs and the Tocks Island project.

Swimming

The evident lack of inland waters available for swimming purposes has necessitated the satisfaction of this extremely popular activity in swimming pools. Figure 4 shows the locations and number of swimming pools, beaches, and lakes in the study area. As expected, the distribution of swimming pools

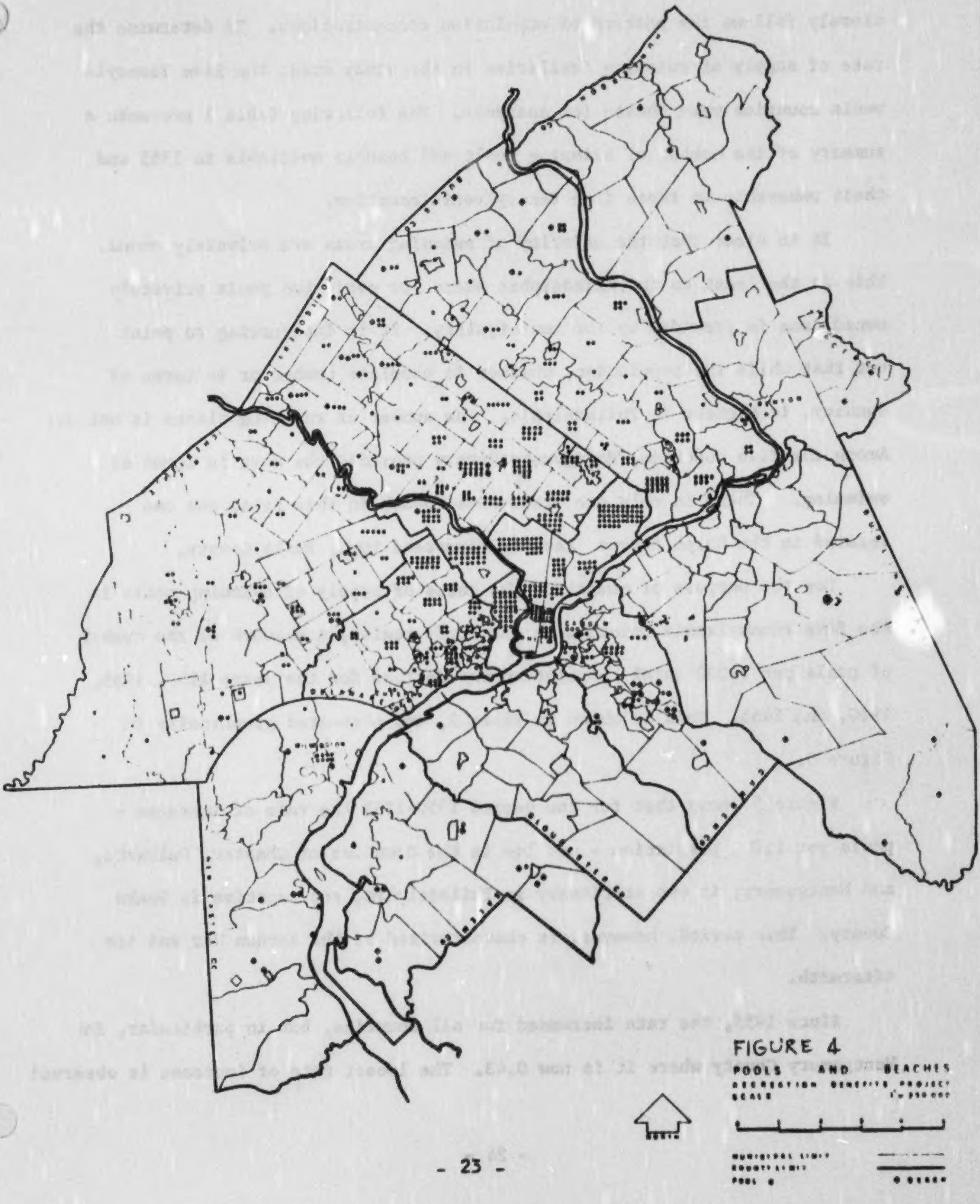


FIGURE 4

POOLS AND BEACHES

RECREATION BENEFITS PROJECT
SCALE
1" = 250,000
NORTH
MUNICIPAL LIMIT
COUNTY LIMIT
POOL ●
● BEACH

closely follows the pattern of population concentrations. To determine the rate of supply of swimming facilities in the study area, the five Pennsylvania counties were chosen for analysis. The following Table I presents a summary of the number of swimming pools and beaches available in 1965 and their ownership in those five Pennsylvania counties.

It is clear that the majority of swimming areas are privately owned. This is the least so in Philadelphia where for every two pools privately owned, one is provided by the municipality. It is interesting to point out that while the population, whether in absolute number or in terms of density, is highest in Philadelphia, the number of swimming places is not so. Among the five counties, Montgomery County provides the most in terms of swimming. There is only one state-owned beach in this area, the one located in the Ralph Stover Park on Plumstead Twp., Bucks County.

For the purpose of comparing the rates of supply of swimming pools in the five Pennsylvania Counties in our study region, a measure of the number of pools per 1,000 total population was derived for the years 1950, 1955, 1960, and 1965. This is shown in Table 2, and presented graphically in Figure 5.

Figure 5 shows that for the period 1950-1955 the rate of increase - pools per 1,000 population - was low in the Counties of Chester, Delaware, and Montgomery; it was stationary in Philadelphia, and negative in Bucks County. This period, however, is characterized by the Korean War and its aftermath.

Since 1955, the rate increased for all counties, but in particular, for Montgomery County where it is now 0.43. The lowest rate of increase is observed

TABLE 1

DISTRIBUTION AND OWNERSHIP OF SWIMMING PLACES BY COUNTY
(1965)

Ownership	Bucks		Chester		Delaware		Montgomery		Phila.		Total	
	P	B	P	B	P	B	P	B	P	B	P	B
Municipal	4	-	2	-	3	-	4	-	46	-	59	-
Commission	-	-	-	-	-	-	-	-	4	-	4	-
Public School District	3	-	-	-	3	-	4	-	-	-	10	-
Private	100	3	76	3	110	1	206	2	142	-	634	9
County	1	1	-	-	1	-	-	1	1	-	3	2
State	-	1	-	-	1	-	1	-	-	-	2	1
Total	108	5	76	3	118	1	215	3	193	-	712	12

P = pools; B = beaches
Source: Pennsylvania Department of Health, Harrisburg

TABLE 2

SUPPLY OF SWIMMING POOLS BY COUNTY (1950-1965)

County	Population (ooo)[1]				Pools[2]				Pools/1,000 Population			
	1950	1955	1960	1965	1950	1955	1960	1965	1950	1955	1960	1965
Bucks	144.6	220	308.6	420	22	27	75	154	0.15	0.12	0.24	0.37
Chester	159.1	180	210.6	260	23	20	50	93	0.14	0.14	0.24	0.36
Delaware	414.2	480	553.2	640	24	38	76	144	0.06	0.08	0.14	0.23
Montgomery	353.1	420	516.7	620	48	69	146	266	0.14	0.16	0.28	0.43
Philadelphia	2,071.6	2,040	2,002.5	2,020	33	40	67	169	0.02	0.02	0.03	0.08
Total	3,142.6	3,340	3,591.6	3,960	151	200	414	826	0.05	0.06	0.12	0.21

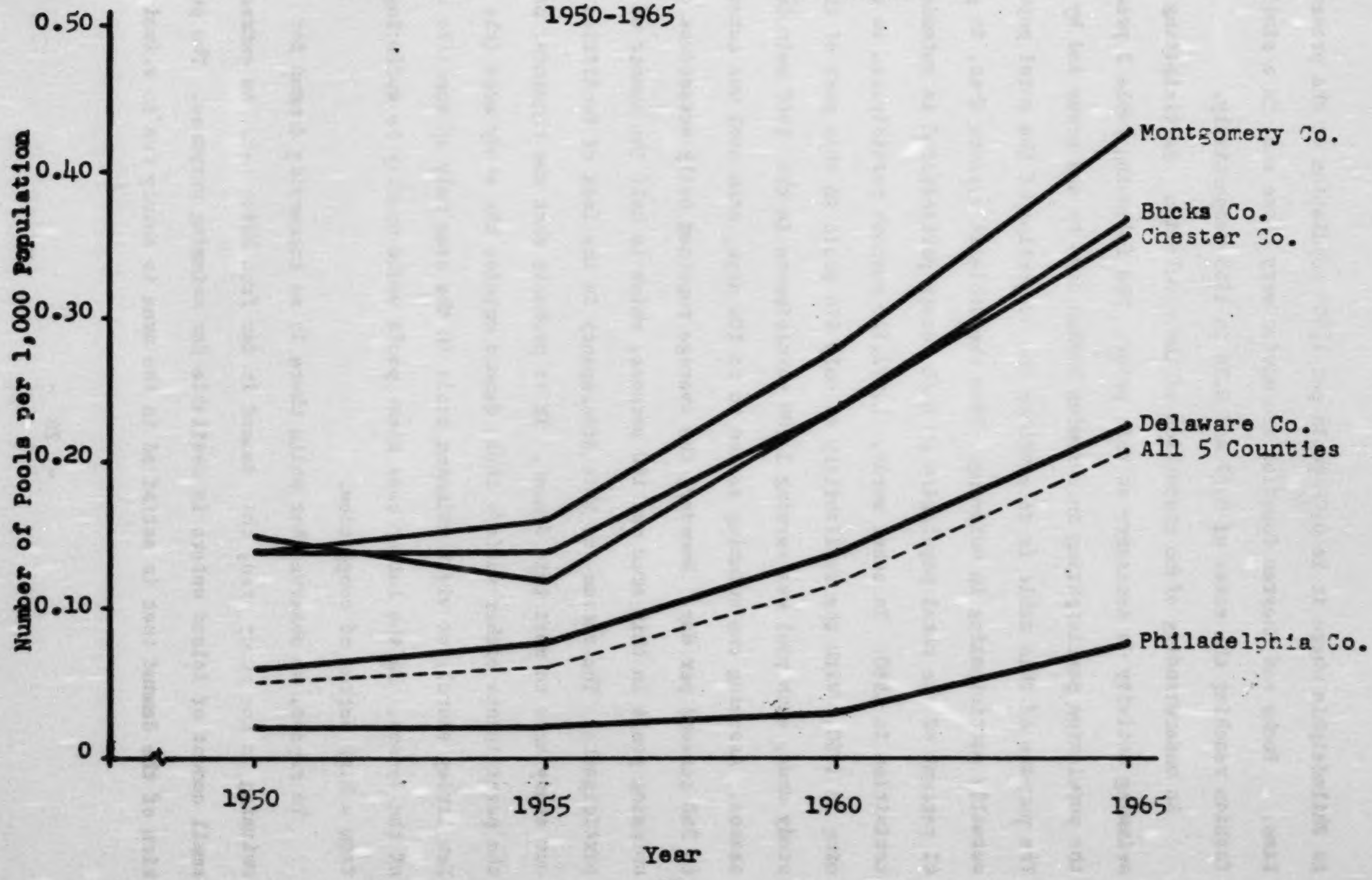
Sources:

1. Population figures for 1950, 1960 are from the U.S. Census of Population, 1950 and 1960 respectively. Figures for 1955 and 1965 were computed.

2. The number of permits issued for pools were extracted from the files of the Pennsylvania Department of Health, Regional Office VII, Philadelphia, and differ somewhat from those of the previous table.

FIGURE 5

SUPPLY RATE OF SWIMMING POOLS BY COUNTY
1950-1965



in Philadelphia where it is 0.08 pools per 1,000 population at the present time. Bucks and Chester Counties are moving very close and, in a similar fashion reaching the rates of 0.37 and 0.36 in 1965 respectively.

An understanding of the proportion of the population participating in swimming activity is necessary at this point. The following Table 3 presents the population participating in swimming broken down by age group and by county. The purpose of this table is to estimate the proportion of the total population actually participating in swimming. From the table it appears that, in general, 41 percent of the total population of each county participated in swimming activities in 1960. In other words, 1,472,720 persons participated in swimming in 1960. With the availability of only 414 pools in this part of the study area, each pool was serving 3,600 participants in the 1960 swimming season. Assuming the swimming season to be 100 days, each pool was catering to 360 persons per day. However, the average reported daily attendance of swimming pools in this area was 180 persons, which is half the number of participants. The reason for this discrepancy is the lack of facilities in our study area to meet this demand. It is probable that the remainder of the participants either satisfy their demand outside the study area (the New Jersey shore), or visit swimming pools in the area only on specific days of the season. In the latter case these pools would usually be suffering from a high degree of congestion.

To repeat, we observe that while there is an increasing demand for swimming in the study area, this demand is far from being met. An extremely small amount of inland waters is available for swimming purposes. The portion of the demand that is satisfied in the area is mainly due to swimming

TABLE 3

PERSONS 12 YEARS OF AGE AND OVER PARTICIPATING IN SWIMMING BY AGE GROUP AND BY COUNTY (1960)

	12-17		18-24		25-34		35-44		45-54		55-64		65 and over		Total S	Total S as % of total pop.
	T	S	T	S	T	S	T	S	T	S	T	S	T	S		
COUNTY		(70%)		(70%)		(65%)		(57%)		(44%)		(45%)		(23%)		
Bucks	30.5	21.4	22.8	16.4	46.4	30.2	50.3	27.7	30.2	13.3	18.3	8.2	19.0	4.4	122.6	40%
Chester	20.8	14.6	19.5	14.1	27.8	18.1	31.2	17.8	23.5	10.3	16.5	7.4	18.1	4.2	86.5	41%
Delaware	51.9	36.3	45.2	32.5	71.0	46.2	86.4	48.2	66.9	29.4	49.2	22.1	45.1	10.4	225.1	41%
Montgomery	47.5	33.3	42.3	30.5	66.4	43.2	78.2	44.6	64.8	28.5	46.9	21.1	46.7	10.7	211.9	41%
Philadelphia	176.7	123.7	180.9	130.3	253.8	165.0	277.9	158.4	259.5	114.2	212.4	95.6	208.8	48.0	835.2	43%
TOTAL	327.4	229.3	310.7	223.8	465.4	302.7	522.2	297.7	444.9	195.7	343.9	154.4	337.7	77.7	1,481.3	41%

Notes: All population figures in thousands
T=Total Population; S=Swimmers

Sources: Total population by age group from the 1960 U.S. Census of Population; percentage of swimmers in each age group from the ORRRC Report 20 "Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults," Chart 1, Page 16.

pools. These, however, are not enough in number and, therefore, induce swimming participants to travel outside the area to satisfy their needs.

Boating

The distribution of boating (and fishing) locations is shown in Figure 6. Appendix D provides a list of boating (and fishing) places broken down by county. In many instances boating and fishing are undertaken in the same location but this is not exclusively so; in some places only boating is possible, while in others only fishing could be pursued.

In 1965, the use of small pleasure boats in the five Pennsylvania Counties, estimated through the number of boat registrations, amounted to 11,456 boats. These included 2,842 in Bucks, 756 in Chester, 2,161 in Delaware, 3,132 in Montgomery, and 2,565 in Philadelphia Counties. Bucks, Delaware, and Philadelphia counties are directly in contact with the Estuary and account for 7,568 boat registrations. The total number of boats in use on the Delaware Estuary on the Pennsylvania side was estimate to be about 10,000 boats, of which 3,000 were at Neshaminy Creek, 4,000 were at the Philadelphia waterfront, and 4,000 were from Philadelphia to Marcus Hook. It is also estimated that out of 10,000 boats, 8,000 are berthed on the Estuary, while the rest are transients. The excess in the number of boats berthed on the Estuary in Pennsylvania (8,000) over boats registered (7,568) there is explained as being due to the fact that many Pennsylvania residents register their boats in New Jersey to avoid a sales tax.

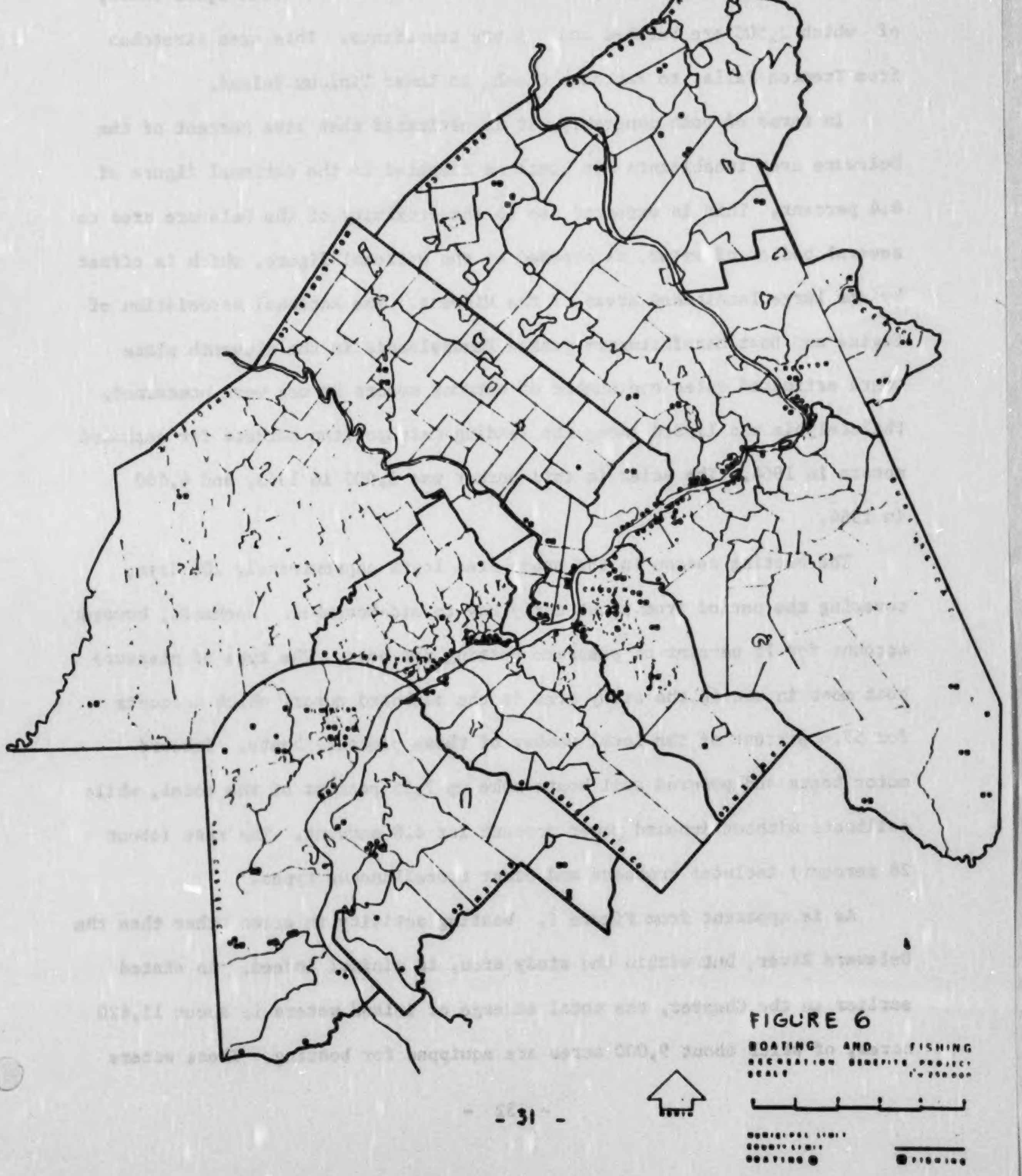


FIGURE 6

BOATING AND FISHING
RECREATION BENEFITS PROJECT
SCALE
1"=250,000
NORTH
MUNICIPAL LIMIT
COUNTY LIMIT
BOATING ●
● FISHING

On the New Jersey side, the total number of boats in use in the northern part of the Estuary has been estimated to be about 3,125 boats, of which 2,500 are berthed and 625 are transients. This area stretches from Trenton Falls, to Rancocas Creek, to Lower Tinicum Island.

In terms of boat ownership, it is estimated that five percent of the Delaware area inhabitants own boats as compared to the national figure of 4.4 percent. This is expected due to the proximity of the Delaware area to several bodies of water, as opposed to the national figure, which is offset by the large landlocked areas of the Midwest. The National Association of Engine and Boat Manufacturers ranked Pennsylvania in the eleventh place where estimated sales and number of outdoor motors in use were concerned. Philadelphia was listed among the leading metropolitan markets for outboard motors in 1964. The sales in this market was 3,900 in 1963, and 4,400 in 1964.

The boating season in the study area lasts approximately 200 days, covering the period from about early May to mid-November. Weekends, however, account for 75 percent of pleasure boating per boat. The type of pleasure boat most in use in the study area is the outboard motor, which accounts for 57.6 percent of the total number of these pleasure boats. Inboard motor boats and powered sail boats make up 7.25 percent of the total, while sailboats without inboard power account for 6.8 percent. The rest (about 28 percent) includes rowboats and other miscellaneous types.

As is apparent from Figure 6, boating activity in areas other than the Delaware River, but within the study area, is minimal indeed. As stated earlier in the Chapter, the total acreage of inland waters is about 11,620 acres, of which about 9,000 acres are equipped for boating. These waters are, therefore, almost all developed, and the increase in acreage will have to come from new areas. The Tocks Island project is the major addition in the region (but not in the study area), and will add about 12,000 acres of inland fresh water. It will be large enough to have some of the characteristics of salt water acres, to the extent that it could attract some salt water boaters who are usually diverted to the New Jersey shore. On the whole, it will slightly change the characteristics of fresh water in this area. The pressure from fresh water demand would still persist. The few other projects (reservoirs) planned in the area are too small to alter the demand for fresh water; they could only help in absorbing the existing manifest demand.

Fishing

Fishing (and other recreation activities) has experienced an increasing popularity, resulting in a growing instream demand for water of quantity and quality adequate to support this activity. Recreation seekers place heavy demand upon the existing streams, lakes, and the estuary of the Delaware River for recreational uses.

In the tidewater area of the Basin, the available quantities of water are generally adequate for recreation uses, but water quality problems are prominent. There is a latent demand for water in presently water scarce areas of the Basin for these recreation activities. The non-tidal areas of the Basin already attract large numbers of water-seeking recreationists. The scarcity of water surfaces to depths adequate for the water-based recreation pursuits in the upper basin is reflected by the increase in vacation trips by many residents of the basin and nearby areas to more distant, but better watered, regions.

The 1960 National Survey of Fishing and Hunting estimated that 10% of the population of the Middle Atlantic States, 12 years old and over, participated in fishing per year. Relating this to the Delaware River Basin population shows that a total of about 475,000 fishermen engaged in 717 million man-days of fishing activity during 1960.

One of the ways recommended by the ORRRC studies to meet the increasing demand in fishing is the increase of fishing in coastal waters. In 1960, 17% of all fishing was done in coastal waters. It is also a recognized fact that the states of New Jersey and Pennsylvania have limited fresh-water resources per capita. The human population is expanding faster than waters can be developed.

An important trend indicated by comparing 1955 and 1960 data (according to ORRRC Report No. 7) concerns the rapid growth of salt-water anglings. In this five year period, the number of persons who fished in salt-water increased 38 per cent (for an average annual increase of 7.6 per cent). Fresh-water anglers, however, increased only 17.6 per cent(for an average growth of 3.5 per cent). It appears, then, that the demand for salt-water fishing will continue increasing if:

a. Salt-water fishing continues to be preferred to fresh-water fishing

b. Other fresh-water fishing areas are not created to satisfy demand.

Few water areas in the Delaware River Basin have been created specifically for public fishing, but fishermen are permitted unrestricted use of approximately 21,000 acres of publicly owned multipurpose reservoirs and limited use of about 12,500 acres of water supply reservoirs. To a considerable extent, fishermen must now depend upon the availability of privately owned lands and natural waters to satisfy their needs. To this end, State fish and wildlife agencies have developed programs to perpetuate fishing in public waters to which access is controlled by private riparian landowners. Public access is being provided to formerly inaccessible waters throughout the basin.

An individual body of water is sought by fishermen in relation to the quality of fishing it produces, its general location in respect to centers of human population, and the degree to which the public has access to such water for fishing. The value of fishing waters, then is broadly relative to the population density of the locale and the quality of fishing afforded.

Discounting the angler who is interested primarily in certain species of trophy fish and some local preferences, people of the U.S. will frequent a wide variety of waters where fishing is good and where facilities and the environment permit enjoyment of the sport. Therefore, it would seem that the Delaware River Basin must satisfy quantity and quality water demands if it is to serve the fishing demands of the recreationalist. If it does not accommodate the quantity demands, it appears a reasonable assumption that the ocean shore will be a strong competitor in attracting the fishermen in the future.

Conclusion

In reviewing the findings of this chapter we can conclude that, in general, existing facilities in terms of quanity and quality are far from being able to satisy the demand for recreation. For the three water-oriented activities under consideration, and because of their dependence on water, the Delaware River offers a great potentiality for its use for recreational purposes. This, however, would solve the problem only in terms of water quantity. The more important factor of quality is the one to face. The picture that emerges from our assessment of the present conditions leaves some doubt regarding the extent and adequacy of proposed facilities. To propose any alternative it is necessary to discover how deficient the facilities are at present and will be in the future. In the process of discovering future deficiencies, consideration should be given to trends in the provision of such facilities as well as future demand. The latter part of this problem, the consideration of demand relationships, will be considered first. This is the task of the following chapter.

CHAPTER V

DEMAND RELATIONSHIPS

Two groups of factors appear to be directly related to variations of recreation demand in general. The first group includes factors which are both interrelated and act similarly in inducing increases in recreation demand under certain circumstances. The second group includes factors that are little related to one another, and appear to affect demand in an independent and particular manner.

A. User-Oriented Factors:

The first group of factors, which could also be viewed as primarily user-oriented, includes income, education, occupation, age and place of residence. These factors are interrelated in several ways. For instance, people with higher incomes have high education, a skilled or professional occupation, and live in suburban areas. The most relevant relationships between participation in recreation activities and each of these factors appear to be as follows:

Income: An increase in income was found correlated with an increase in the use of public outdoor recreation facilities up to about $10,000 annual family income according to the 1960 income distribution in the U.S. Beyond that income level a shift of preferences is indicated for other types of recreation activities which usually fall outside of what is usually considered to be the sector of public concern.

Table 4 and Figure 7 present the income - participation relationships for the four recreation activities considered in this study. Three different patterns seem to emerge from the consideration of these relationships. Swimming and picnicking appear to follow the same pattern

TABLE 4

INCOME AND PARTICIPATION IN THE NORTHEAST U.S.
JUNE - AUGUST 1960

Annual Family Income	Percent of Persons 12 Years and Over Participating				Activity Days Per Person			
	B*	F	P	S	B*	F	P	S
Less than $1,500	6	10	31	13	0.36	0.60	1.49	1.01
$1,500-$2,999	9	9	37	32	0.96	0.28	0.88	3.22
3,000- 4,499	20	20	59	45	0.95	2.26	2.70	6.15
4,5000-5,999	17	21	60	58	0.88	1.80	2.63	6.27
6,000 - 7,999	25	23	70	65	1.02	2.24	3.04	7.96
8,000- 9,999	30	26	59	66	2.02	1.31	3.17	8.95
10,000-14,999	33	31	56	60	2.61	2.00	3.97	10.39
15,000-and over	40	22	55	62	7.58	2.80	3.35	16.00

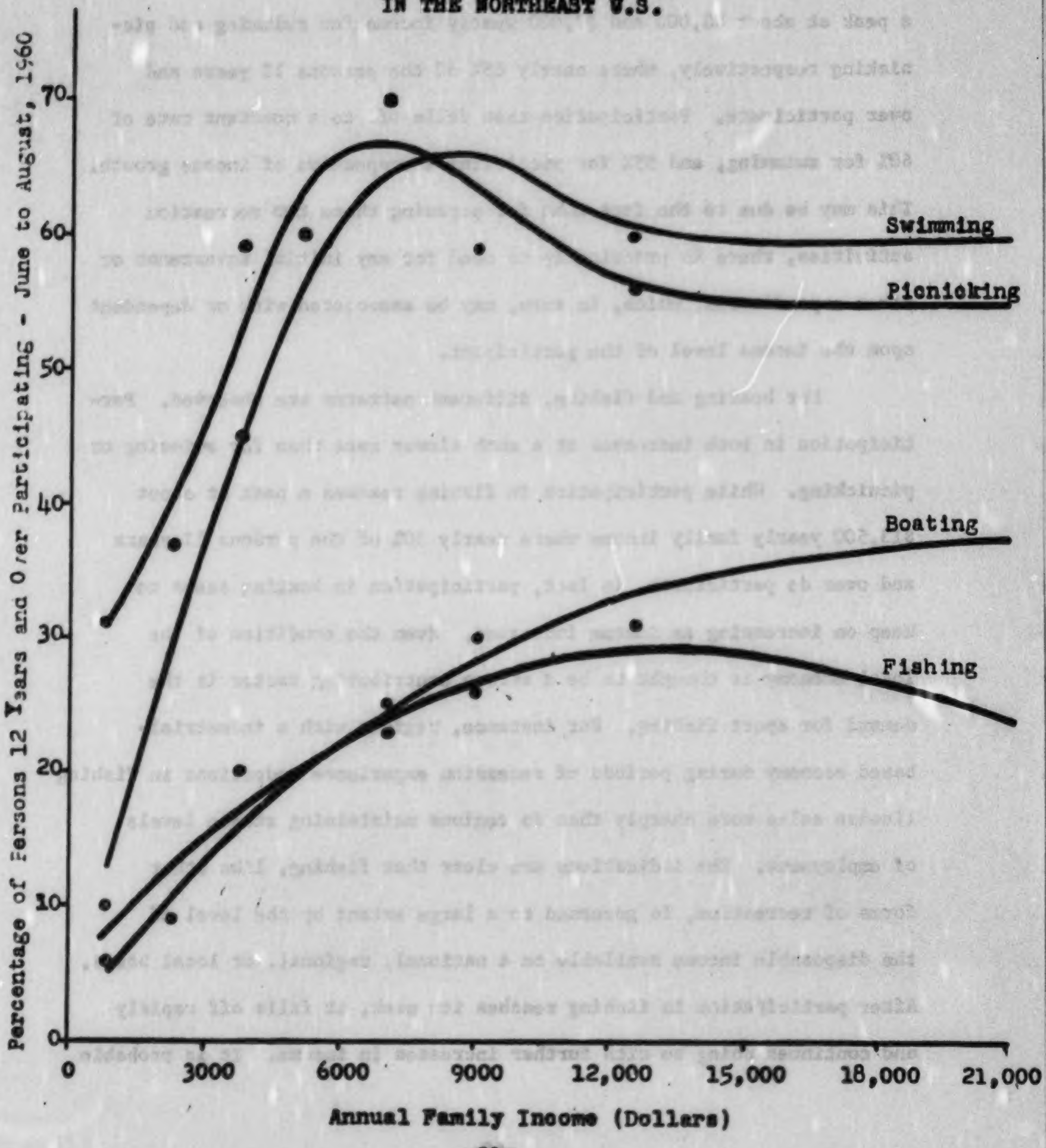
* Other than sailing or canoeing

B= boating
F= fishing
P= picnicking
S= swimming

Source: ORRRC Report 19 "National Recreation Survey," pp. 125, 128, 133 and 136.

FIGURE 7

INCOME AND PARTICIPATION IN THE NORTHEAST U.S.



of increase in the number of people participating in those activities as annual family income grows. Participation in both activities reaches a peak at about $8,000 and $7,000 yearly income for swimming and picnicking respectively, where nearly 65% of the persons 12 years and over participate. Participation then falls off to a constant rate of 60% for swimming, and 55% for picnicking irrespective of income growth. This may be due to the fact that for pursuing these two recreation activities, there is practically no need for any initial investment or other expenditures, which, in turn, may be associated with or dependent upon the income level of the participant.

For boating and fishing, different patterns are observed. Participation in both increases at a much slower rate than for swimming or picnicking. While participation in fishing reaches a peak at about $13,500 yearly family income where nearly 30% of the persons 12 years and over do participate, in fact, participation in boating seems to keep on increasing as income increases. Even the condition of the local economy is thought to be a strong contributing factor in the demand for sport fishing. For instance, regions with a industrial-based economy during periods of recession experience reductions in fishing license sales more sharply than do regions maintaining stable levels of employment. The indications are clear that fishing, like other forms of recreation, is governed to a large extent by the level of the disposable income available on a national, regional, or local basis. After participation in fishing reaches its peak, it falls off rapidly and continues doing so with further increases in income. It is probable that, after reaching high income levels, participants in this activity switch over to other forms of recreation such as boating. It may be noted, however, that when factors other than income are taken into consideration (such as the availability of the facility), somewhat different figures are obtained. In the Detroit area,[1] for example, the highest percentage of the population participating in boating and fishing is found among those families earning an annual income between $5,000 and $7,000, perhaps because of the presence of Lake Michigan in its immediate area. To a greater extent, income is also a major factor in boating participation because of the relatively high expenditures involved in owning a motor boat, trailer, and the provision of storage facilities for both.

Out of the four activities considered, income appears to affect boating the most. To repeat, boating is an expensive form of recreation, both in initial investment and maintenance. A small outboard speedboat, and a trailer, cost about $1,500 to $2,000, a relatively substantial investment, for most urban residents. To maintain a boat, one has not only to think of gas and repairs, but also one must have either a large vacant garage and trailer, a house at the shore available for storage, or pay a marina for storage. The relative variations in average boat ownership by income groups is presented in Table 5.

1/ Home Survey of Regional Recreation Activities, Detroit Metropolitan Area Planning Commission, 1959.

TABLE 5

INCOME AND BOAT OWNERSHIP*

Annual Family Income	Percentage of Persons 12 Years and Over Owning Boats
less than $1,500	3.9
$1,500 - 2,999	5.3
3,000 - 4,499	9.0
4,500 - 5,999	12.8
6,000 - 7,999	17.1
8,000 - 9,999	17.9
10,000 - 14,999	23.2
15,000 and over	N.A.

*Boats and /or motor other than inboard motor boats

Source: ORRRC Report, "National Recreation Survey,
Table 5.47, page 373

From Tables 4 and 5, it becomes clear that income shows a directly proportional relation with both boat ownership and participation. Also, the rate of activity days per person is less for lower-income than for upper-income groups. To the extent that more people are in the lower rather than in the upper-income group, the total amount of time that people send boating out of those who participate is found, in cases, to be roughly the same for all income groups, especially where the actual participation costs by income group are not very high and do not vary much.

In general, one may conclude that water-oriented recreation activities retain their appeal to high income groups and, in fact, become increasingly popular when the annual income of the family is on the high side. These activities require relatively greater investment in time and money from the part of the participant and require more extensive and particular facilities from the part of the providing sector. In particular, income is at present the most important factor affecting boat ownership, and indirectly affecting participation in boating recreation activities.

Education and Occupation: On several occasions the available data have indicated that families whose householder is a high school graduate demonstrate the strongest preferences for public parks and picnic facilities. Families with grammar school or college graduate householders indicate lesser preference for public outdoor recreation activity, or conversely, an increasing preference for other kinds of recreation activities and other types of facilities. However, more comprehensive data, made available by the ORRRC studies, indicate that this is not always the case. In fact, Table 6 and Figure 8 present a good indication of the relations which were found to exist between the level of education and the degree of participation in each of the four recreation activities that are included in the present study.

Table 6 indicates that the highest percentage of the population 12 years of age and over participating in boating is for those with 1 to 3 years of college education. For fishing, the highest percentage is for those with 1 to 3 years of high school, while for picnicking and swimming, the highest percentage are found for those with 4 years or more of college. The highest number of days a person spends in the four activities is found for those with at least some college education, except for fishing where persons with 1 to 3 years high school education spend the greatest number of days per person on this activity.

TABLE 6

EDUCATION AND PARTICIPATION IN THE NORTH EAST U.S. JUNE - AUGUST 1960

Years of Education	Percent of Persons 12 Years and Over Participating				Activity Days Per Person			
	B*	F	P	S	B*	F	P	S
Grammar School								
4 years or less	3	5	25	14	0.05	0.09	0.62	0.39
5 - 7 years	8	15	44	29	0.93	0.78	1.72	2.60
8 years	11	111	36	33	0.21	0.89	0.01	1.68
High School								
1 - 3 years	17	26	55	42	0.89	1.88	2.62	3.54
4 years	22	18	63	58	1.12	0.96	3.10	7.57
College								
1 - 3 years	32	22	51	55	2.28	1.28	3.70	9.12
4 years or more	29	19	66	71	1.23	1.03	3.35	6.38

*Other than sailing or canoeing

B=boating
F=fishing
P=picnicking
S=swimming

Source: ORRRC Report 19, National Recreation Survey, pp. 125, 128, 133, and 136.

FIGURE 8

EDUCATION AND PARTICIPATION IN THE NORTHEAST U.S.

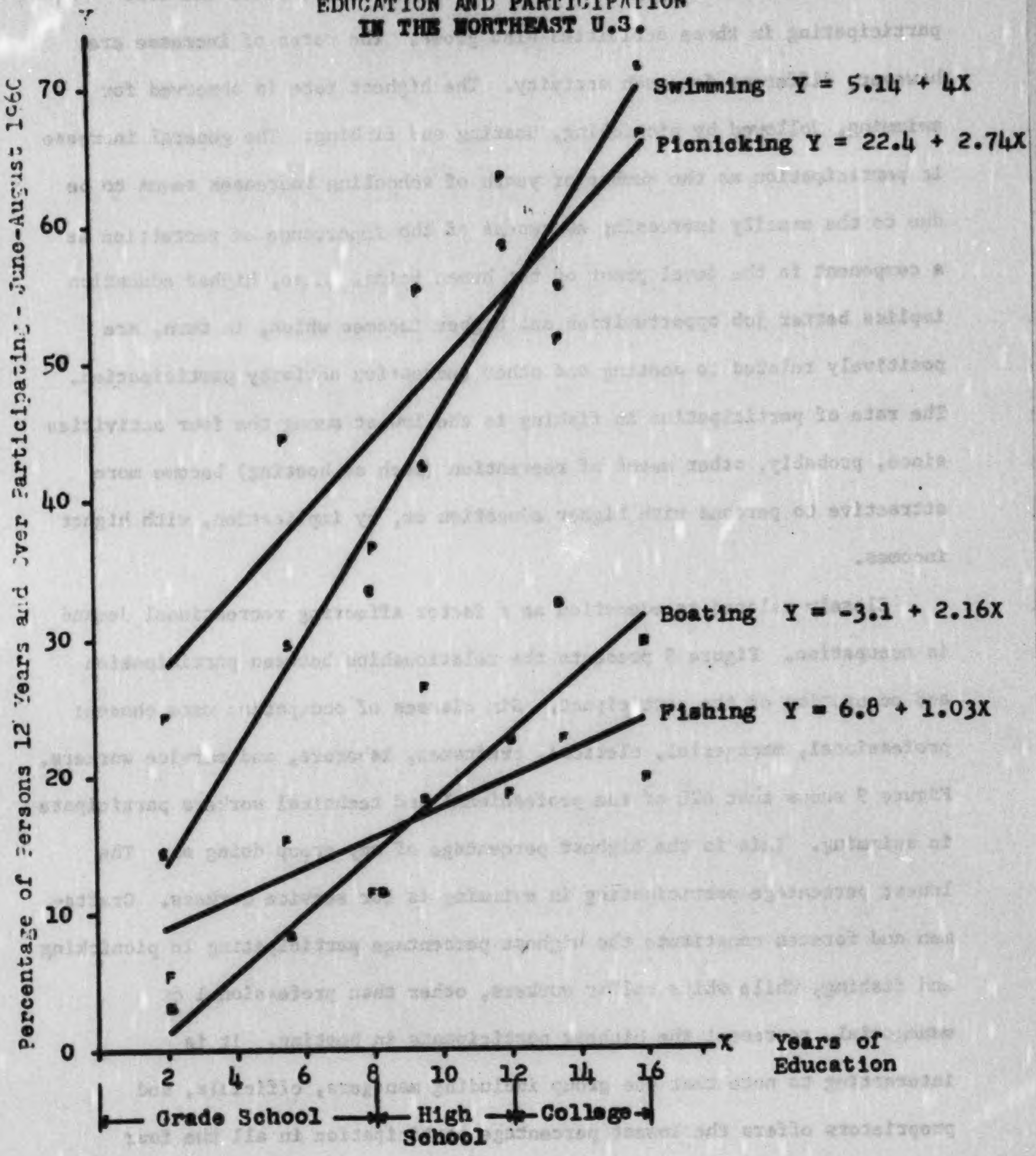
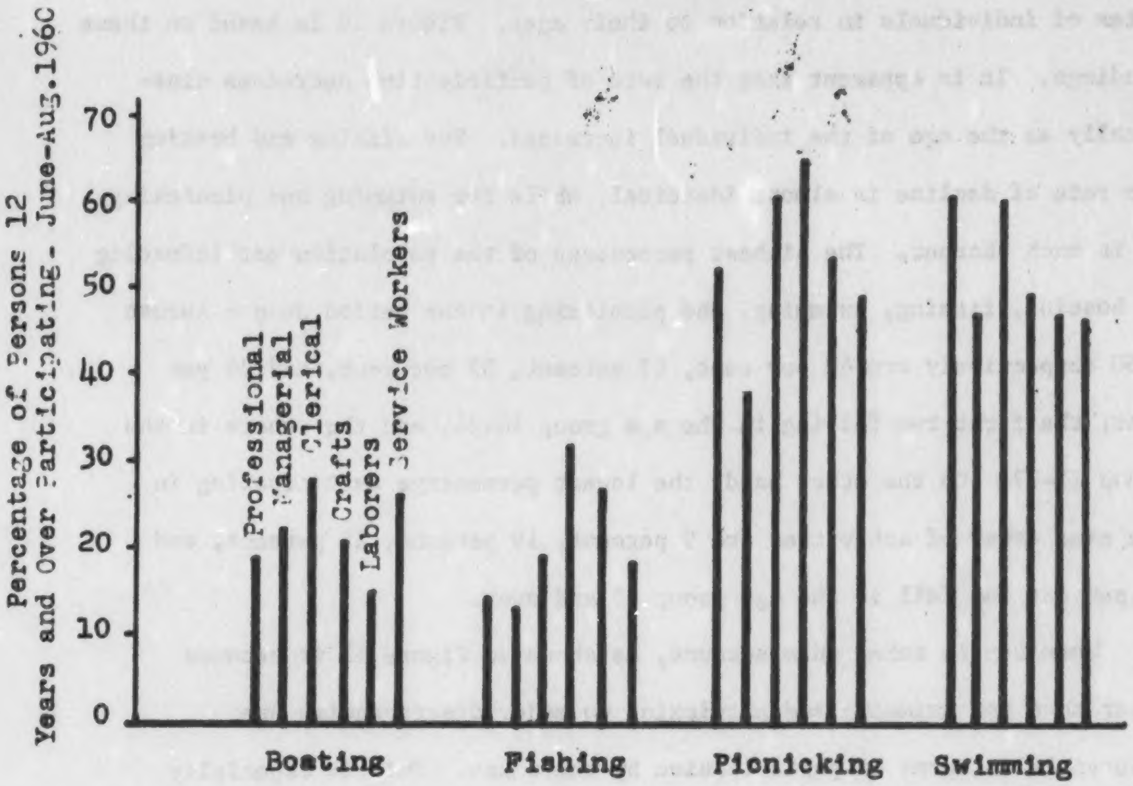


Figure 8 shows that for the four activities as the number of years completed in education grows, the number of persons 12 years and over participating in those activities also grows. The rates of increase are, however, different for each activity. The highest rate is observed for swimming, followed by picnicking, boating and fishing. The general increase in participation as the number of years of schooling increases seems to be due to the usually increasing awareness of the importance of recreation as a component in the development of the human being. Also, higher education implies better job opportunities and higher incomes which, in turn, are positively related to boating and other recreation activity participation. The rate of participation in fishing is the lowest among the four activities since, probably, other means of recreation (such as boating) become more attractive to persons with higher education or, by implication, with higher incomes.

Closely related to education as a factor affecting recreational demand is occupation. Figure 9 presents the relationships between participation and occupation of the participant. Six classes of occupation were chosen: professional, managerial, clerical, craftsmen, laborers, and service workers. Figure 9 shows that 62% of the professional and technical workers participate in swimming. This is the highest percentage of any group doing so. The lowest percentage participating in swimming is for service workers. Craftsmen and foremen constitute the highest percentage participating in picnicking and fishing, while white collar workers, other than professional or managerial, represent the highest participants in boating. It is interesting to note that the group including managers, officials, and proprietors offers the lowest percentage participation in all the four activities except boating.

FIGURE 9

OCCUPATION AND PARTICIPATION IN THE NORTHEAST U.S.



On the basis of the available data, therefore, it seems that insofar as education and occupation are concerned, both have a direct and positive relationship with the level of participation with regard, most of all, to swimming, less so with regard to picnicking, and indirect with regard to boating. No apparent relation is revealed where fishing is concerned.

Age: Findings of the ORRRC studies report variations in the participation dates of individuals in relation to their ages. Figure 10 is based on these findings. It is apparent that the rate of participation decreases drastically as the age of the individual increases. For fishing and boating the rate of decline is almost identical, while for swimming and picnicking it is much sharper. The highest percentage of the population participating in boating, fishing, swimming, and picnicking in the period June - August 1960 respectively are 43 per cent, 47 percent, 83 per cent, and 84 per cent; the first two falling in the age group 18-24, and the others in the group 12-17. On the other hand, the lowest percentage participating in the same order of activities are 9 percent, 19 percent, 13 percent, and 37 percent and fall in the age group 65 and over.

When sex is taken into account, as shown in Figure 11 it becomes clear that for swimming and picnicking no major discrepancies are observable in terms of participation by the sexes. This is especially true between the ages of 35 and 55 where participation in swimming and picnicking is almost identical by males and females. The differentiation increases for fishing and boating and is highest for the former. The highest percentage of the male population 12 years of age and over participating in fishing is 58 percent while that for the female population is 18 percent in the same age groups 12-17. After the age of 55 approx-

FIGURE 10

AGE AND PERCENTAGE PARTICIPATION IN THE NORTHEAST U.S.

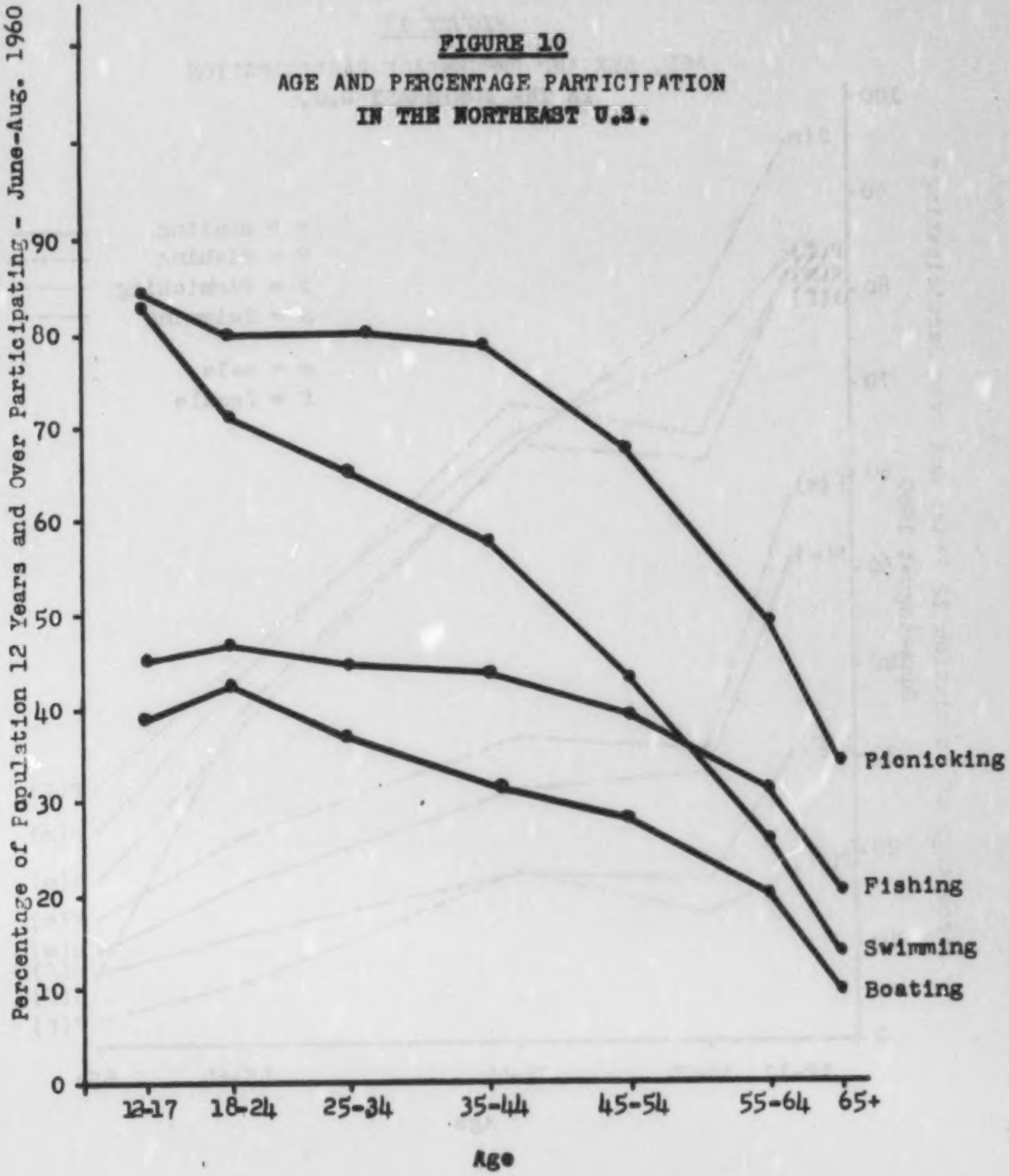
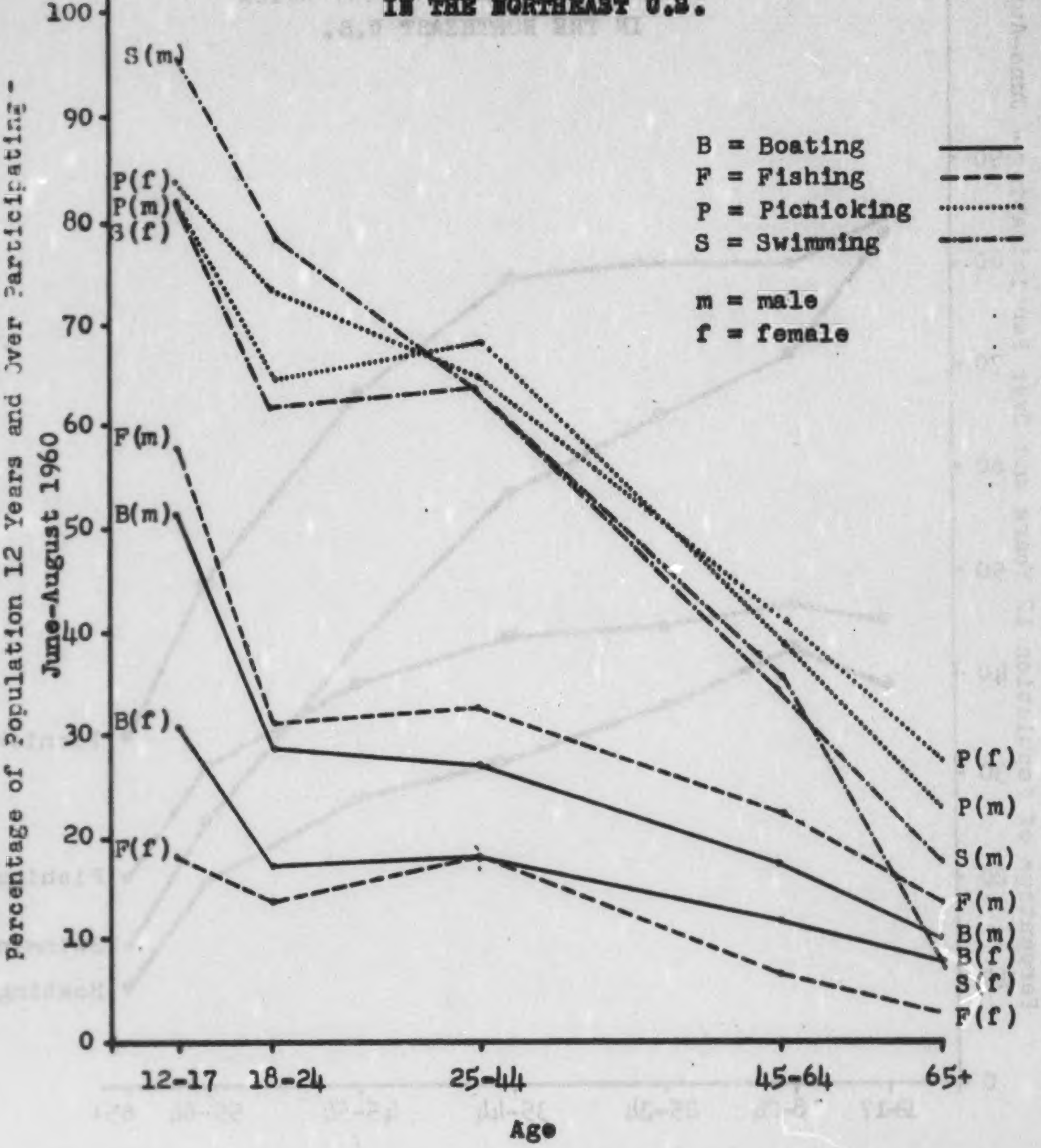


FIGURE 11

AGE, SEX AND PERCENTAGE PARTICIPATION IN THE NORTHEAST U.S.



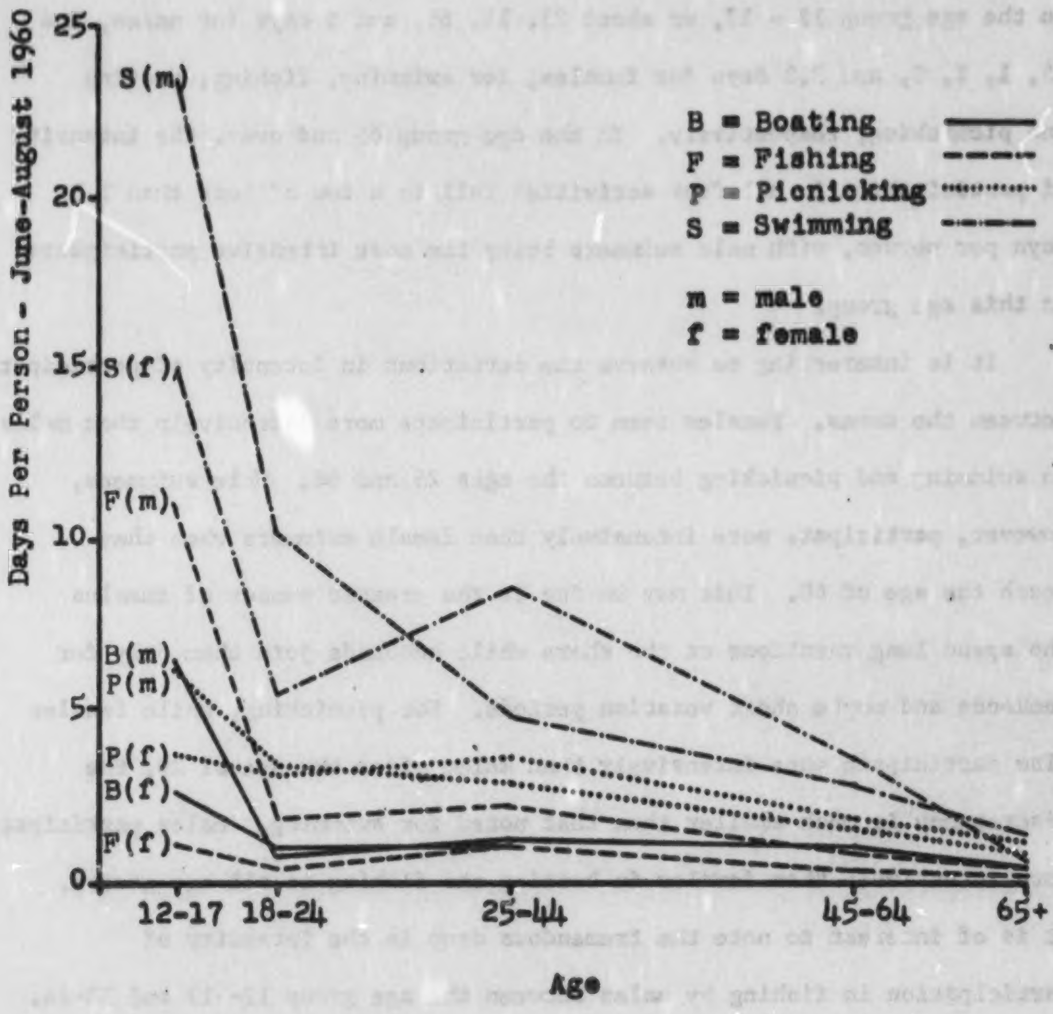
imately, the discrepancies between male and female participation in fishing and boating decreases. For swimming and picnicking the opposite is true; the discrepancies start increasing after that age.

Age has also the sharpest influence in terms of the intensity of participation. Intensity is measured in terms of days per person participating, and is shown in Figure 12 for the four activities during the same period June - August 1960. The highest intensity for the four activities fall in the age group 12 - 17, or about 23, 11, 65, and 6 days for males, and 15, 1, 2, 5, and 3.3 days for females, for swimming, fishing, boating and picnicking, respectively. In the age group 65 and over, the intensity of participation in all four activities fall to a low of less than 1.5 days per person, with male swimmers being the most intensive participants in this age group.

It is interesting to observe the deviations in intensity of participation between the sexes. Females seem to participate more intensively than males in swimming and picnicking between the ages 25 and 44. Male swimmers, however, participate more intensively than female swimmers when they reach the age of 60. This may be due to the greater number of females who spend long vacations at the shore while husbands join them only for weekends and maybe short vacation periods. For picnicking, while females also participate more intensively than males after the age of 20, the discrepancy is much smaller than that noted for swimming. Males participate more intensively than females in boating and fishing in all age groups. It is of interest to note the tremendous drop in the intensity of participation in fishing by males between the age group 12- 17 and 18-24. The drop is from about 11 days for the former to less than 2 days for the latter group. The reason for this drop could be thought of as mainly

FIGURE 12

AGE AND DAYS PER PERSON PARTICIPATION IN THE NORTHEAST U.S.



due to a change in interest from the part of the participants.

To conclude we can state, that, in general, age is inversely proportional to the amount and intensity of participation. For an activity such as boating, the correlation between age and participation is independent of income. It is more likely due to health factors and interest in physical activity. Another explanation may be applicable in this case. Older people are usually associated also with large families, more civic and social responsibilities and, by and large, are less interested in physical activity.

Race: A number of reasons may explain the differential participation rates in recreational activities that is currently found to exist between the white and non-white population. Among these reasons may be a difference of attitude toward such activities, a differential relative availability of facilities, as well as variations in both income and preferences.

TABLE 7

RACE AND PARTICIPATION IN THE THE NORTH EAST U.S.
JUNE - AUGUST 1960

Race	Percent of Persons 12 years And over Participating				Activity Days Per Person			
White	B*	F	P	S	B*	F	P	S
White	21	21	57	53	1.46	1.86	2.90	7.18
Non-white	12	20	58	43	0.26	0.32	1.60	1.63

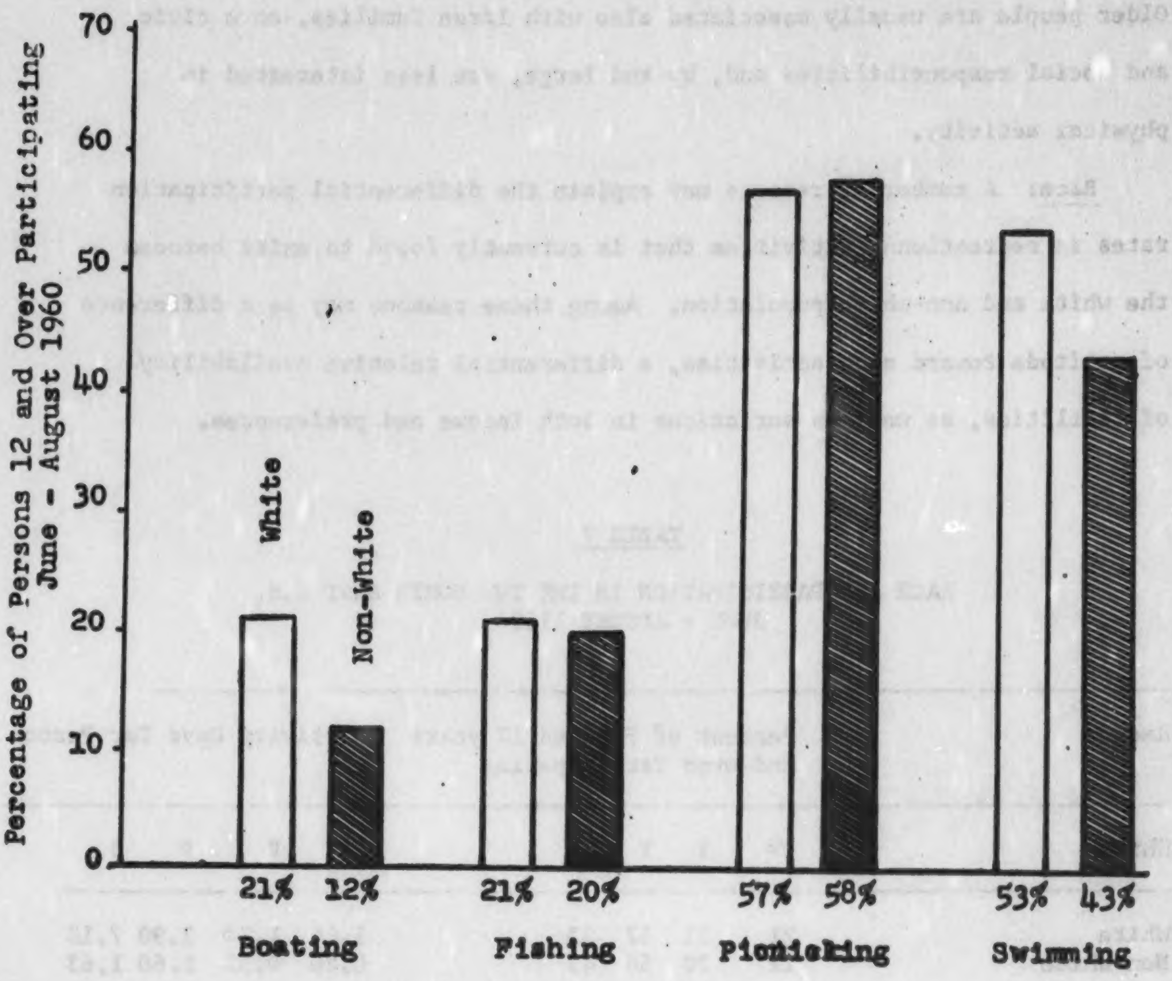
* Other than sailing or canoeing

Source: ORRRC Report 19 National Recreation Survey, pp. 125, 128, 133, and 136.

B=boating
F=fishing
P=picnicking
S=swimming

FIGURE 13

RACE AND PARTICIPATION IN THE NORTHEAST U.S.



As noted from Table 7 and Figure 13 the percent of person 12 years and over participating is higher for whites than it is for non-whites for the four activities under consideration except for picnicking where the opposite appears to be the case. The difference, however, is very small, and is more than offset when the number of activity days per person is considered. Whites spent an average of 2.90 activity days per person picnicking during the period June - August 1960, while non-whites spent only 1.30 days. The lowest percentage of non-white is observed for boating participation 12%, and corresponds also, to a low average rate per person (0.26). This is to be expected currently, of course, becuase of the low income of the non-white population and the fact that a relatively high income is a prerequisite for boating participation. The highest number of activity days per person is observed for swimming by whites (7.18 days), which is also accompanied with the highest rate of activity days for non-white population (1.63). While the non-white population participates in the greatest number in picnicking, they do so slightly less intensively than for swimming.

Place of Residence: The rate of participation by type of recreation activity and by area of residence (defined byfine locational types) is reported in Table 8. This table presents the percentage of persons 12 years and over participating in the four activities under consideration as well as the number of activity days per person in the North East U.S. in the period June - August 1960 according to the place of residence of participants.

TABLE 8

PLACE OF RESIDENCE AND PARTICIPATION IN THE NORTH EAST U.S.

JUNE - AUGUST 1960

	Percent of Persons 12 Years and Over Participating				Activity Days Per Person			
Place of Residence	B*	F	P	S	B*	F	P	S
Residence in SMA	18	18	54	53	1.35	1.31	2.50	6.44
Urban (over 1 million)	18	18	51	57	1.36	0.94	2.63	6.82
Urban (less than 1 million)	19	18	58	49	1.37	1.91	2.36	5.65
Rural	15	20	57	44	0.88	1.96	2.13	6.10
Residence not in SMA	29	28	68	51	1.51	3.15	3.81	8.04
Urban	20	21	60	44	1.16	1.69	2.15	6.37
Rural, non-farm	38	34	72	57	1.92	4.39	4.85	9.77

*Excluding sailing and canoeing

B=boating
F=fishing
P=picnicking
S=swimming

Source: ORRRC Report 19, National Recreation Survey, pp. 125, 128, 133 and 136.

It is clear from Table 8 that people in suburban areas of non-metropolitan regions (not in SMA) demonstrate a higher rate of participation than the city population (residents of SMA, 1960). This holds true for all four activities. The percent of persons 12 years and over participating in swimming appears to be higher where residences are within an SMA rather than the contrary. However, the intensity of participation (activity days per person) varies in reverse manner. For all four activities the intensity of participation is higher in suburban and ex-urban areas than it is in the cities. For instance, the highest rate and intensity of participation among all the residential locations defined occur in rural non-farm areas for all four activities.

Of course, residential location is in reality a reflection of a number of other factors. The greater rate of participation in the suburban and outlying areas is in reality attributable to the greater incomes also found in these areas. It appears, therefore, that the type of residence rather than the place of residence is of significance. It seems reasonable to expect that although the desire to participate in outdoor recreation activities can be expected to fluctuate due to the type of place or place of residence in only a few extreme cases, the area or location where this desire is possible or preferable to be met may vary considerably. In the case of single-family large-lot residential accommodations, the tendancy to have a picnic there rather than in a public park is bound to to be substantial. The reverse can be expected in the case of high density, apartment or row-housing accommodations with hardly any backyard facilities. If this speculation is reasonably accurate, we should then expect a tendency for a decreasing rate of demand for outdoor recreation facilities for public use in the future. In other words, while income increases will tend to generate, up to a point, greater needs for such facilities, the lower density residential development which, according to present experience, usually accompanies higher income households, will tend to decrease these needs to the extent that the available private facilities will be able to partially accommodate activities such as picnicking, swimming, game playing, etc.

B. Environmental Factors:

The second group of factors emphasized the relationship between the user and his environment, physical and societal, and includes leisure time, availability of recreation facilities, availability of transportation facilities, and/or cost of participating in a recreation activity.

Leisure Time: Studies of how the population spends its leisure time have been made by ORRRC and other individual researchers.[2] According to these studies, two significant findings emerge. First, with regard to daily leisure time, about 40 percent of the people appear to participate in active sports. The active sports, defined in a list by spontaneous mention, include fishing, swimming, and boating. Second, no pronounced or systematic differences in the manner people spend their leisure time are apparent among groups of different socio-economic characteristics. Small variations by sport are more than compensated for by additional sports or emphasis on a few sports.

2/ See, for instance, ORRRC Report 20, "Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults, "Chapters 3 and 4, 1962, and Marion Clawson, "How Much Leisure, Now and in the Future?" in Leisure in America: Blessing or Curse?, American Academy of Political and Social Science, Monograph No. 4, Philadelphia, April 1964.

The data available for vacation and weekend leisure time indicates that only 25 percent spent their time in picnicking, 30 percent in swimming, and 37 percent in fishing. Other independent estimates by Clawson[3] indicate that roughly 35 percent of the national leisure time in 1960 was spent in outdoor activities. Leisure time seems to be a particularly important factor in boating since that activity consumes a relatively great deal of time. Few can go boating for an hour or two as one would run over and play tennis, for instance. In general, trip information showed that boating consumes at least a full day's trip, if not a weekend or vacation, and this necessitates a good amount of available leisure time. The importance of leisure time is substantiated by the ORRRC surveys where 26 percent of the sampled population stated that they did not go boating because of lack of time. This response was second only to income restrictions (32%).

In this brief note on the leisure time factor it is reasonable to suggest that while some notion about the restrictive effect of leisure time is clearly possible the problem of accurately defining and estimating the relationship between the level of participation in outdoor recreation and amount and type of leisure time appears still unsolved. This is true when present participation rates are considered, and even more apparent when projections are attempted. In fact, it appears that for projection purposes, estimates of the effect of increased leisure time on participation rates in outdoor recreation activities will have to be made on the basis of certain prior assumptions of the type and extent of the relationships between the two variables.

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[3] Clawson, Marion, "How Much...,"' op. cit.

Availability of Recreation Facilities: Studies may by ORRRC have shown that a larger segment of the population would participate in recreation activities were it not for various restrictions placed upon, or felt by, many people. Five types of restrictions have been identified, and their effect shown, in Table 9. A comparison among these restrictions would indicate the relative extent to which the lack of facilities tends to impede participation in various recreation activities.

TABLE 9

PERCENT OF PERSONS 12 YEARS AND OVER RESTRICTED FROM PARTICIPATING BY TYPE OF RESTRICTION (SUMMER 1960)

Restrictions	B	F	P	S
1. Facilities	9	7	5	13
2. Financial	32	9	7	7
3. Time	26	48	32	32
4. Ability	2	5	4	5
5. Other	3	6	10	5

1. Facilities overcrowded, inadequate or distant
2. Lack of money, equipment or transportation
3. Lack of available time due to work or family responsibilities
4. Physical condition, age (too young or too old), or fear
5. Other externally imposed restrictions

B=boating
F=fishing
P=picnicking
S=swimming

Source: ORRRC Report 19, National Recreation Survey, pp. 177

Table 9 shows that the lack of available time is the most restrictive factor upon participation in all four entries, except boating, where the importance of lack of time is superseded by the importance of financial restrictions. However, the lack of adequate or conveniently located facilities becomes the second major restrictive factor with regard to swimming, and the third with regard to boating and fishing. Among the four activities presented in the table, picnicking seems to be the least affected by the lack of adequate facilities. It is of interest to note that ability (defined by physical condition; age, such as too young or too old; or fear), has, according to this survey, the least effect on any of the four activities under discussion.

In general, the availability of recreation facilities appears to have a positive influence on the demand for outdoor recreation activities particularly for participation in swimming activities. Nonetheless, the available data indicate that the relationship seems to be elastic and relevant only within the narrow limits of the term availability. It appears that, within a continous cost function (measured in travel time, money fees, or any other measurement), outdoor recreation facilities are always available for use if only the potential user could afford the particular cost involved.

Availability of Transportation Facilities: The availability of transportation facilities and the cost of participating in recreation activities act in a manner similar to the availability of recreation facilities. This factor constrains the demand when an increased amount of travel or cost is required for reaching appropriate facilities. Available data clearly indicate that an increased amount and a higher quality of transportation facilities to and from recreation areas permit and, in certain cases induces, a greater use of outdoor recreation facilities in a region while, at the same time time, it makes for a better distribution of such uses.

Normative studies on outdoor recreation facilities establish standards for providing such facilities in a community on the basis of distance. The use of an effective distance in such studies measured in miles or travel time over which a recreation facility can be considered capable of providing service, is in essence a reflection of an average distance over which the majority of people are willing to travel in order to visit the facility.

Empirical studies have also dealt with travel distance to outdoor recreation facilities. Frequent reference is made in these studies to an average distance that people would like to travel or already travel. For instance, in the Detroit area it was found that people were willing to travel 6 to 10 miles for a picnic outing, up to 5 miles for just rest and scenery enjoyment, and 21 to 25 miles for outdoor swimming.

More specifically, the Detroit data [4] provide information on the percentage of the population visiting parks in the Detroit study area. This visitation rate was, however, based on a 4-day average survey data. It was necessary, therefore, to translate this information into visitation rates on a summer Sunday basis, based on a breakdown of traffic count during the survey hours by park and in each of the four survey days (including a Sunday) which was presented in the Detroit report. The

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4/ Park Users Survey, Detroit Metropolitan Area Regional Planning Commission, April 1950.

Sunday-rate factor was calculated by comparing the traffic count for Sunday and for the 4-day average for each park. This is detailed in Appendix B of this report.

On the basis of the Detroit data, a correlation analysis has been carried out in an attempt to relate the mean park distance (MPD) defined as the mean distance between a sub-area (planning unit), and each specific park in the region (X_1), the population density (X_2), the median family income (X_3), to both percentages of the population visiting parks on a 4-day average basis (Y_1) and on a summer Sunday (Y_2). The significant relationships which were reached in this empirical study are presented as follows:

For Y_1 1. $\log Y_1 = 22.35 - 1.46 \log X_1$

2. $Y_1 = -3.12 + 1.98 \log X_2$

3. $Y_1 = -4.07 + 0.22 \ X_1 + 2.12 \log X_2$

4. $Y_1 = 10.37 + 0.01 \ X_1 + 2.21 \log X_2 - 3.73 \log X_3$

For Y_2 5. $\log Y_2 = 2.65 - 1.50 \log X_1$

6. $Y_2 = -5.25 + 3.40 \log X_2$

7. $Y_2 = -5.59 + 0.01 \ X_1 + 3.45 \log X_2$

8. $Y_2 = 28.88 - 0.03 \ X_1 + 3.66 \log X_2 - 8.88 \log X_3$

Equations 1 and 5 are also presented graphically in Figure 14 with a simple transformation of the X axis into an arithmetic scale.

In more detail, this figure indicates, on the horizontal axis, the average airline distance from the centroid of a planning unit to the centroids of each park in the Detroit Metropolitan Region. The vertical axis represents the proportion of residents in a planning unit who have visited any of the regional parks in the Detroit Region during an average summer day and on a summer Sunday. Figure 14 represents only the relationship which appears to exist between average distance to regional parks and proportion of people visiting these parks. From this figure it becomes apparent that, the use of parks in a metropolitan region is clearly associated with the distance between the recreation facilities and the area of residence of the potential park users.

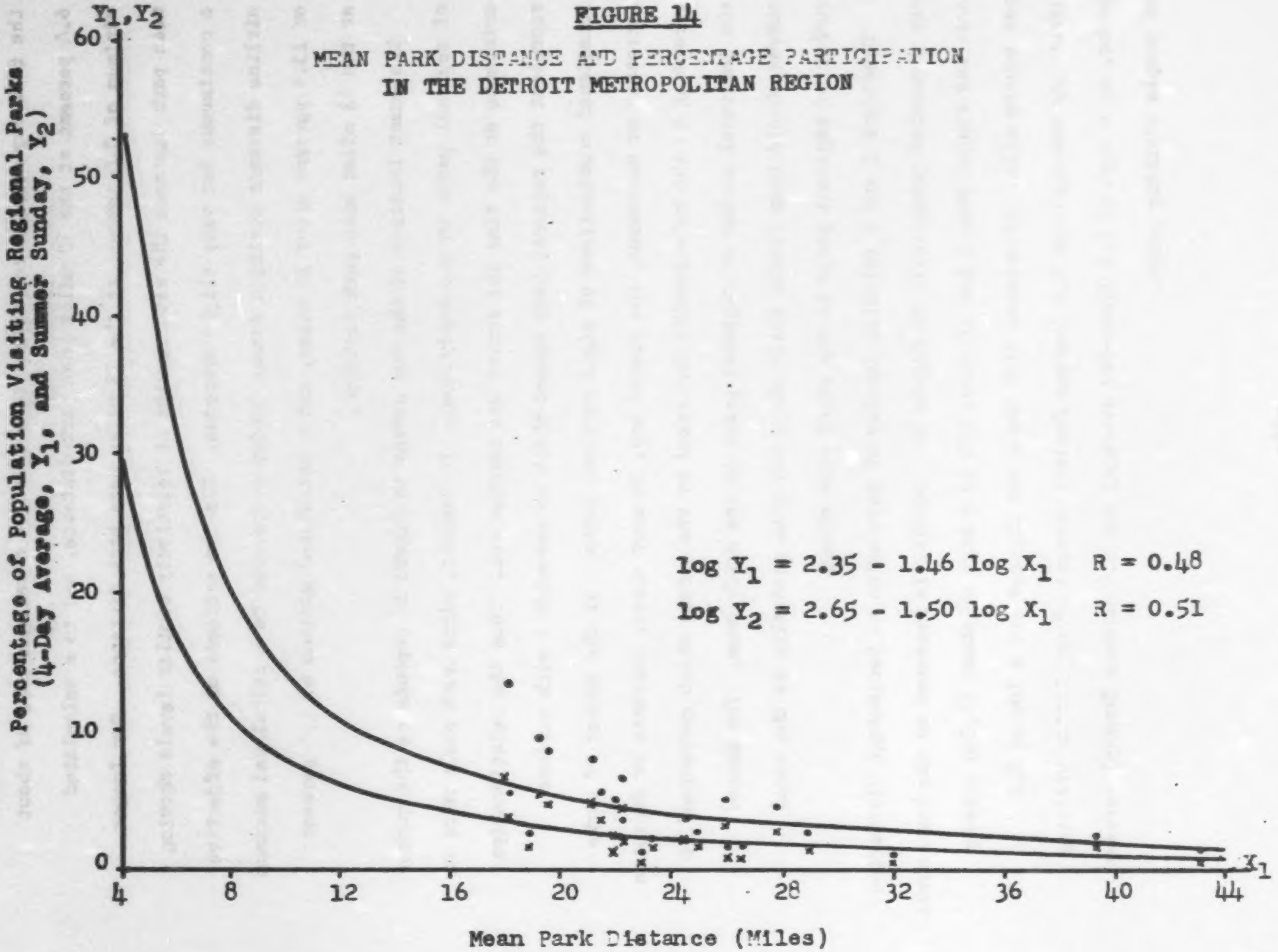
The overall average rate of visits for the four-days period (July 4, Thursday, Sunday and Tuesday) is 4.5 percent of the people in the region. That of an average summer Sunday is 7.7 percent of the total population.

The Detroit data are limited to mean park distances ranging from about 16 miles to about 43 airline miles. For less than 16 miles there are no available data to confirm the relationship. For more than 43 miles it appears that the relationship does not hold in general, or does not hold, at least, for the generalized average rates used in this study. For Sunday, the effective mean park distances seems greater than the effective mean park distance for weekday. This speculation is based on the fact that the people of the Detroit area reported an average travel distance during a Sunday park-outing approximately 18 miles long. For the same type of outing on a weekday, they reported an average travel distance of only 12 miles.

These two extremes of the effective airline mean park distances for

FIGURE 14

MEAN PARK DISTANCE AND PERCENTAGE PARTICIPATION IN THE DETROIT METROPOLITAN REGION



the four-day average correspond to a calculated maximum rate of about 6.4 percent at the 18 miles mean park distance, and to a calculated minimum of 0.6 percent at the 23 miles mean park distance. For longer mean park distance the rate remains at relatively similar levels showing a continuous but very slight decrease. The two extremes of the affective airline distance during a summer Sunday correspond to a calculated maximum of 13.4 percent about 18 miles, and a calculated minimum of 1.4 percent at the 43 miles mean park distance.

The exact location of the two curves in Figure 14 depends on the number of regional parks in the study area. In Detroit, eight such parks were in existence at the time the survey was carried out. Thus the relationships represent the regional park demand which is associated with various locational combinations of eight regional parks. If the number of parks increases or decreases, the demand may, in most cases, increase or decrease according to the relationship indicated by the curves which correspond to the new total number of regional parks in the study area. The demand curves should then retain their shape but rise gradually as the total number of regional parks in the study area rises.

Equations 2 and 6 relating density of population to percentage visitation are presented graphically in Figure 15. Density is measured on the horizontal axis and ranges from a low of about 100 to a high of about 15,000 persons per square mile. Associated with these two figures are a low of 0.5 (four-day average) and 0.8 (summer Sunday) percent of population visiting parks, to a high of 5.6 (four-day average) and 9.4 (summer Sunday) percent of people visiting parks.

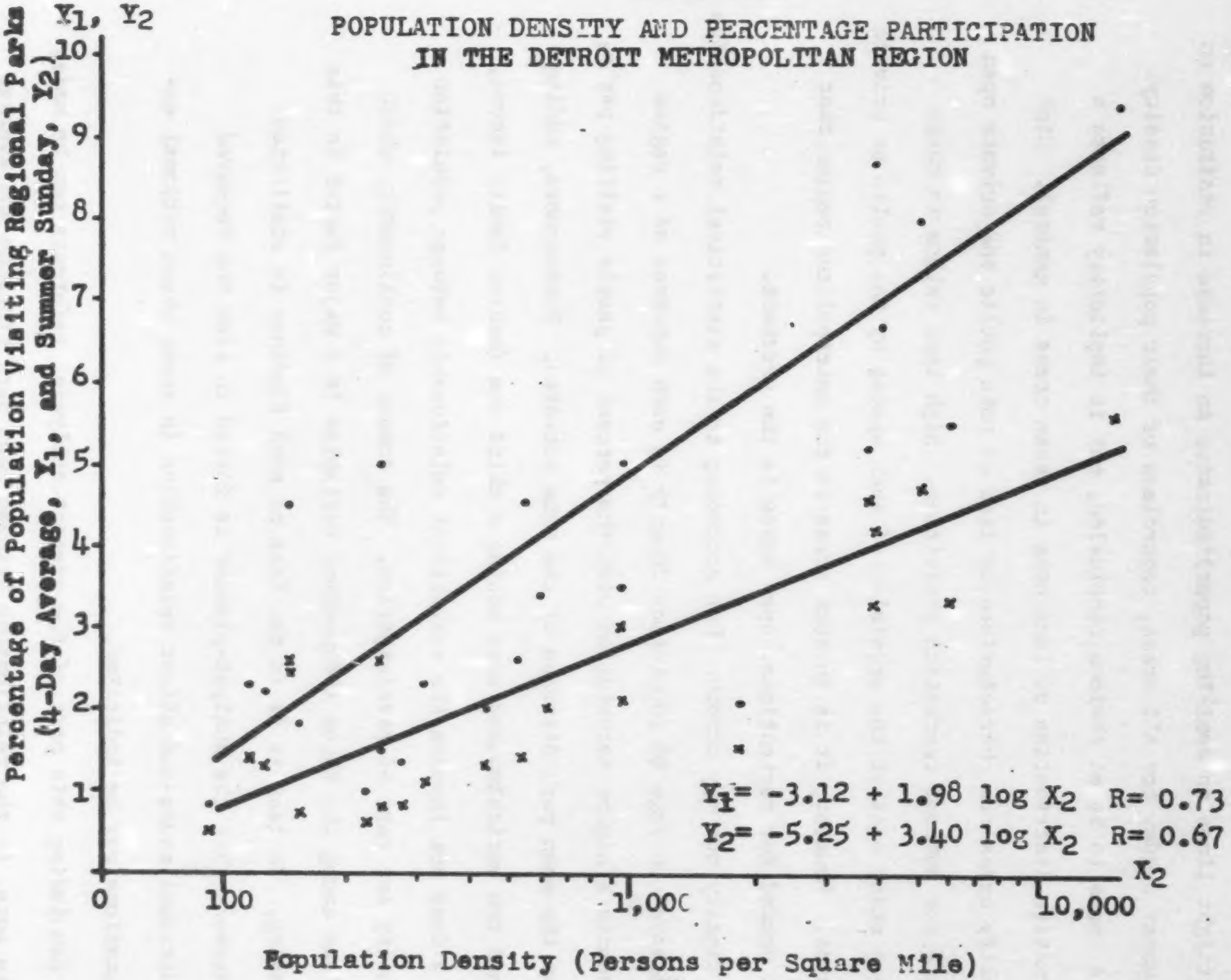
Figure 15 indicates that as the density of the population increases in a sub-area of a region the percentage of population of this sub-area visiting major public parks increases. The divergence of the two curves (straight lines on semi-log paper)indicates an increase in visitation on a summer Sunday for all areas, regardless of their population density. This seems to be an obvious conclusion, but it implicitly reflects a normative distribution of land uses in urban areas in general. High density areas are characterized by lack of both public and private open space for outdoor recreation activities. High land values in these areas stand against the provision of such spaces by the public or private sector. However, it is in such areas in the metropolitan region that the demand for recreational open space is the greatest.

Finally one may observe that according to the statistical relationships presented on page 63 population density in each sub-area of a region presents a higher correlation with the percent of people visiting parks, than the mean park distance of the same sub-area. Furthermore, adding these two variables,and even adding a third one (median family income, X_3) does not improve the statistical relationship between population density and rate of participation. The amount of co-linearity which exists among the three independent variables is a major factor in this finding. In fact it is in the face of such findings in statistical endeavors that the analyst-planner is forced to seek the required additional cause-and-effect relationships in areas where rational expectations may be indicated.

Concluding this part of the present analysis, reference can be made, once more, to the relationship between mean park distance and average

FIGURE 15

POPULATION DENSITY AND PERCENTAGE PARTICIPATION IN THE DETROIT METROPOLITAN REGION



travel cost to and from the various parks of a metropolitan region. Variations of this distance are in effect variations of the travel cost, implicitly necessitated. The significance therefore of variations in the mean park distance can be seen as being essentially the same as the significance of variations in the average travel cost between each sub-area and the various major public outdoor facilities in the metropolitan region.

CHAPTER VI

PROJECTION OF DEMAND RELATIONSHIPS AND RELEVANT TRENDS

The projection of those factors that affect future demand should preceed any actual attempt to project outdoor recreation demand. In addition, certain national trends towards recreation in general, and water-oriented recreation in particular should be taken into account in such an attempt. In fact, data from the TVA were considered most appropriate for this purpose due to the long-range nature of the TVA experience and the role that fresh water has played throughout this experience. [5]

Accordingly this chapter will discuss three major aspects of projecting outdoor recreation demand. The first aspect involves the general trends in outdoor recreation demand in the recent past; the second involves the projection of those variables that were proved to be important in the previous chapter; and the third covers the projection of the demand relationships themselves.

A. Recreation Demand Trends

As mentioned above, data from the TVA has proved to be most pertinent for the analysis of general trends in water-oriented recreation. Recreation visits to the TVA lakes are significant in the sense that they are made for the purpose of engaging in one or more the activities that the lakes offered.

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[5] See Outdoor Recreation for a Growing Nation -- TVA's Experience with Man-Made Reservoirs, The Tennessee Valley Authority, Tennessee, 1961. Supplementary tabulated information bringing the contents of the above source up to the year 1964 was also made available.

The total package of water-oriented activity available included the four activities with which this study is primarily concerned; viz., swimming, boating, fishing, and picnicking.

The following Table 10 summarized information on recreation visits to the TVA lakes. In Column 1 the areas of individual lakes at full pool have been aggregated cumulatively by year. The surface area of lakes, it is noted, has slightly increased from 1947 to 1964, that increase being the order of 5%. The number of visits listed in Column 2 are those made to all lakes and reservoirs for recreation purposes. They are shown in Figure 16. Column 3 computes the rates of those visits per acre and yearly figures are also depicted in Figure 16. In Column 4 the number of recreation visits listed in Column 2 has been discounted to 1947 area of lakes available. The small divergence between the figures in Column 2 and those in Column 4 reflect the small increase in lake acreage between 1947 and the present time (5%). Column 5 presents total population figures for selected census and mid-census years for the seven states covered by the TVA region, while in Column 6 the number of visits per person for those years is computed.

As noted from Figure 6, hand-fitted regression lines were applied to the data presented here, and projections were made for 1976 and 2000. Pertinent projection figures as well as those for 1960 are presented below in Table 11.

TABLE 10

RECREATION VISITS IN THE TVA LAKES

	(1)	(2)	(3)	(4)	(5)	(6)
Year	Area of Lakes (000 acres)	Visits (000,000)	Visits Per Acre	Visits (000,000) Disc. '47	Pop. (000,000)	Visits per Person
	(A)	(B)	(B/A)	(C)	(D)	(C/D)
1947	569	7.3	12.9	7.3		
1948	"	11.0	19.3	11.0		
1949	575	13.5	23.4	13.3		
1950	"	16.7	28.9	16.5	22.3	0.74
1951	583	18.4	31.6	17.9		
1952	"	19.8	33.9	19.3		
1953	588	23.0	39.1	22.2		
1954	"	25.5	43.3	24.6		
1955	"	27.8	47.2	26.8	22.9	1.17
1956	592	30.2	50.9	29.0		
1957	"	33.1	55.9	31.7		
1958	"	36.6	61.8	35.1		
1959	"	40.5	68.2	38.8		
1960	"	42.4	71.5	40.7	24.5	1.66
1961	"	42.5	71.7	40.8		
1962	"	45.0	75.7	43.1		
1963	"	45.5	76.8	43.6		
1964	"	47.6	79.6	45.1	26.2	1.72

Source:

Source:	Column 1	From "Facts About Major TVA Dams and Reservoirs,"
	Column 2	From :Extent of Recreation Development and Use of TVA Lakes and Lake Frontage Property - Comparative Dams 1947 through 1964," item 16.
	Columns 3, 4, and 5 computed	
	Column 5	From "Statistical Abstract of U.S. 1964 and 1965, and the 1960 Census of Population (Population figures are for the States of Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia).

FIGURE 16

RECREATION VISITS IN THE TVA LAKES

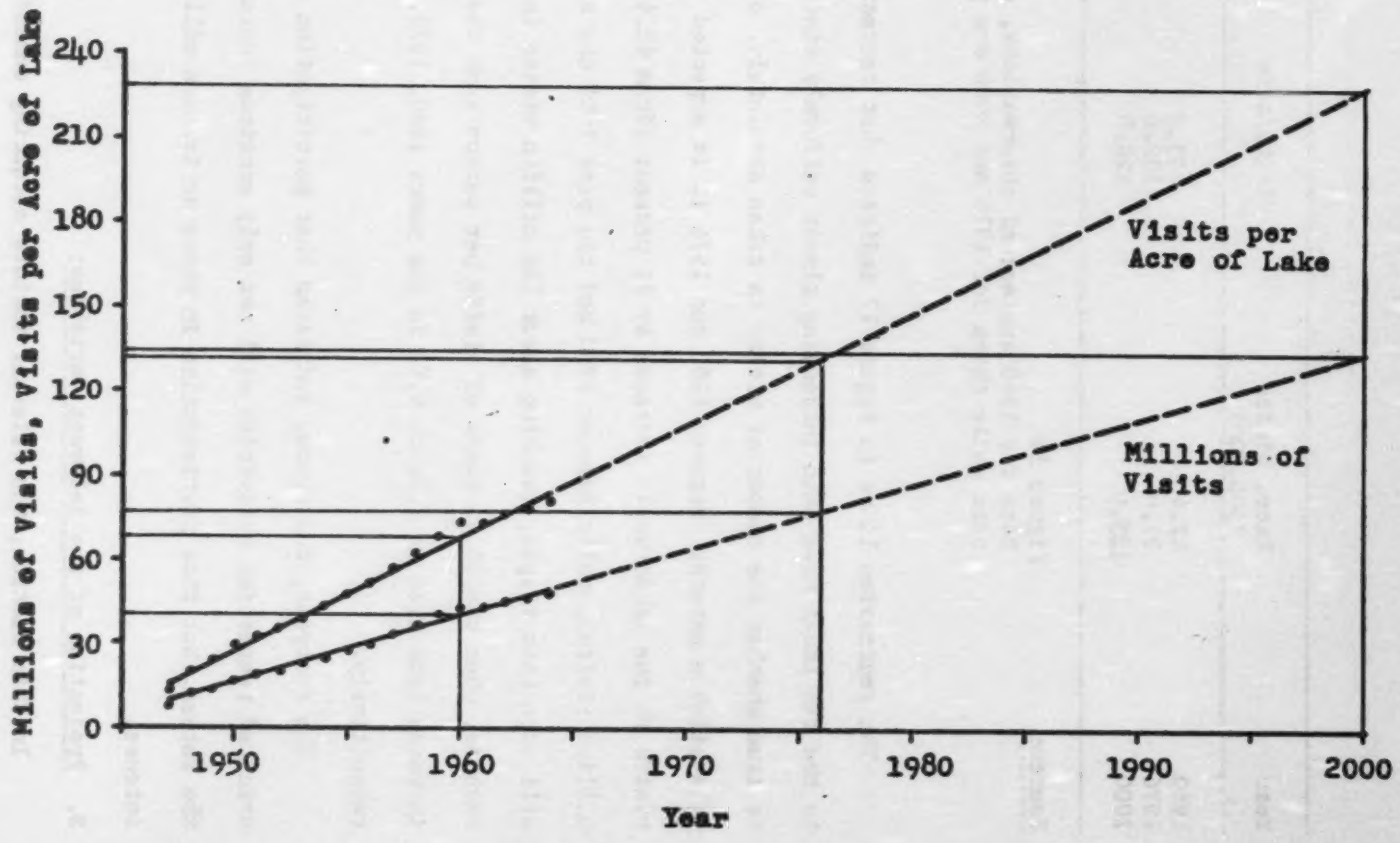

TABLE 11

PRESENT AND FUTURE RECREATION VISITS IN THE TVA LAKES

Year	Recr. Visits (000,000)	Visits/acre	Visits/person
1960	42.4	71.5	1.66
1976	77.0	132.0	2.74
2000	135.0	228.0	4.52

Source: Figure 16
Data for 1960 are actual observations, and computed rate while those for 1976 and 2000 are projections.

The regression lines in Figure 17 indicate that recreation visits to the TVA Lakes have been increasing almost uniformly since 1947. This is true whether the number of visits is taken absolutely, or per acre of available waters. Between 1960 and 1976 it is expected that recreation visits to the lakes would increase by 82 percent (from 42.4 to 77.0 million visits), while between 1960 and the year 2000 the number of visits will more than triple, reaching about 135 million visits in a year. These changes, when viewed in terms of visits per person show that they will increase from 1.66 to 2.74 to 4.52 in the years 1960, 1976, and 2000 respectively.

The analysis, therefore, indicates that participation in water-oriented recreation activities will not only continue increasing in the future, but that participation in those activities will also be more intense.

B. Projection of the Relevant Variables:

In this section, the relevant factors affecting demand and indentified in the previous chapter will be projected for the year 1976 and 2000. These factors are income, age and sex compositions, and leisure time. In addition, one should also consider the increase in population in the study area.

Population: On a national basis, it is expected that the U.S. population will increase by 28.5 percent in 1976, while for the year 2000, it is expected to double in comparison to the 1960 figures. Using these same rates of increase for our study area, one can expect that from a figure of 5 million in 1960, the population and the study area will reach 6.5 million in 1976, and 10 million in the year 2000. Local projections, however, show that the study area will include 6.4 million persons in 1976, and 8.5 million persons in the year 2000.

Age and Sex: A different age and sex distribution of the population is also expected for the years 1976 and 2000. Table 12 presents these changes.

For 1976, Table 12 shows that the percentages of the population in all age groups, except that from 35 to 64 years of age, will be larger compared to those for 1959. There will be more children, youth, and elderly people. The percentages increase in specific age groups will, of course have a significant effect on the amount of participation and extent of facilities for various recreational activities. In the year 2000, it is expected that the percentage of the population under 14 years of age will decline while that between 14 and 19 years of age will continue to increase.

TABLE 12

PERCENT DISTRIBUTION OF POPULATION BY AGE AND SEX (UNITED STATES)

Age Group	1959			1976			2000		
	M	F	T.	M	F	T	M	F	T
Under 14	30.4	28.6	29.4	31.4	29.3	30.3	29.4	30.3	28.6
14-19	9.1	8.6	8.9	11.0	10.4	10.7	11.3	11.6	11.0
20-24	6.4	6.2	6.3	8.4	8.0	8.2	8.0	8.2	7.9
25-34	13.0	13.0	13.0	13.8	13.2	13.5	13.5	13.7	13.2
35-44	13.3	13.6	13.4	9.8	9.6	9.7	11.9	12.0	11.8
45-54	11.4	11.7	11.6	9.6	9.9	9.8	10.3	10.3	10.3
55-64	8.4	8.9	8.7	8.1	8.0	8.5	6.6	6.4	6.8
65 & Over	8.0	9.4	8.7	7.9	10.6	9.3	9.0	7.5	10.4

M= male; F=female; T=total

Source: ORRRC "Outdoor Recreation for America.

A decline is also noted for those between 20 and 35 years of age. On the other hand, while a decline was noted in 1976 for the age group 35 to 64, an increase is observed for that group for the year 2000, but up to 55 years of age. This increase would however, still constitute a smaller percentage than that for 1959. Between 55 to 64, a decline is observed for the year 2000, as was also noted for 1976. The age group 65 and over still presents an increase over the 1976 percentage. The consistent increase for both 1976 and 2000 is, therefore, found in the age groups 14 - 19 (the teens) and 65 and over (the elderly).

In terms of sex, it is noted that the decrease in the year 2000 in the percentage of the population in the age groups up to 14, and between 20 and 35 years of age, will affect the male population. Again the most consistent increase in both 1976 and 2000 is noted for both males and females in the age groups 14 to 19. In the age group 65 and over, a relative decrease in the female population in the year 2000 is noted. In general, however, the changes observed in the male-female distribution of the population in the projection years do not appear as import as the general distribution in terms of age, especially with regard to participation in recreation activities.

Income: Not only a population increase is expected, but also a parrelleling increase in gross national product and disposable income is in view. The increase in income will affect the whole population, but to a varying degree. There will be shifts in income groups. The following Table 13 presents the percentage distribution of consumer units by income groups for 1957 as well as for the two projection years.

TABLE 13

PERCENTAGE DISTRIBUTION OF CONSUMER UNITS BY INCOME GROUPS

(UNITED STATES)

Income (1959 Dollars)	Percent of Consumer Units 1957	 1976	 2000
Below $2,000	13.8	7.5	4.2
2,000 - 3,999	20.8	10.6	7.8
4,000 - 5,999	23.8	13.2	7.6
6,000 - 7,499	14.5	11.3	6.8
7,500 - 9,999	13.3	17.8	13.1
10,000 -14,999	8.8	22.9	25.5
15,000 -19,999	2.6	8.2	15.9
20,000 -24,999	1.0	3.8	8.0
25,000 - or more	1.4	4.7	11.1
	100.0	100.0	100.0

Source: ORRRC Report "Outdoor Recreation for America" Table 22, Page 220.

As noted from the table, the percent of consumer units earning up to $7,500 a year will decrease in 1976 as compared to 1960, and will continue doing so in 2000. It is expected that units in the income bracket from $7,500 to $10,000 annual earnings, will increase in 1976, and then decrease in 2000 to a level lower than what it was in 1957. As opposed to this general decrease, consumer units earning a yearly income of $10,000 or more will increase for both 1976 and 2000. This is where the shift in income grouping occurs. In 1957 the highest percent (23.8) of consumer units was found to be in the income bracket earning annually between $4,000 and $6,000. It is expected that the highest percent of consumer units in 1976 (22.9) and now (25.5) be found in the income group earning from $10,000 to $15,000 annual income. This factor will be particularly relevant in the projection of participation in recreation especially in those activities such as boating where income appeared to be an important factor.

Leisure Time: Projections of leisure time show a consistent decline in working hours for all occupations in 1976 and 2000. For all industries taken as a whole the decline proceeds from 39 working hours a week in 1960, to 36 in 1976, and down to 32 in the year 2000. Table 14 shows the expected working hours per week by occupation.

The table shows that in 1960 the number of hours of work per week in most industries was equivalent to the mean for all industries. The only deviations were a high of 40.0 hours in wholesale and retail trade, and a low of 37.0 in both mining, and finance, insurance, and real estate. In 1976, wholesale and retail trade maintain the highest weekly work hours

TABLE 14

AVERAGE STANDARD (SCHEDULED) WORK WEEK FOR NON-AGRICULTURAL WORKERS BY INDUSTRY

Industry	Work week Hours		
	1960	1976	2000
Total, All Industry	39.0	36.0	32.0
Mining	37.0	34.0	30.3
Contract Construction	39.0	35.4	31.6
Manufacturing	39.0	36.0	32.6
Transportation and Public Utilities	39.0	35.8	32.0
Wholesale and Retail Trade	40.0	36.2	32.3
Finance, Insurance, and Real Estate	37.0	33.5	29.9
Science and Miscellaneous	39.0	35.7	32.0
Government	39.0	35.2	31.5

Source: ORRRC Outdoor Recreation for America Table 25, Page 222.

expected while finance, insurance and real estate maintain the lowest, or 33.5 hours. In the year 2000, the latter still holds the lowest figures with 29.9 hours per week, while manufacturing becomes the industry with the greatest number of expected work hours per week, or 32.6 hours.

In general we can state that a consistent increase in the availability of leisure time is expected in the future, but with varying degrees of availability depending on the type of occupation one is holding.

C. Projection of Demand Relationships

Those factors that affect recreation demand and that were projected in the previous section will do so, not separately but in a composite manner. In this section such composite effects will be presented for 1960 and projected for 1976 and 2000. The unit of demand that will be used is the "activity day," defined as a visit by one individual to an outdoor recreation development or area for recreation purpose during any portion or all of a 24-hour-day period.

The composite effect of all the relevant factors has been studied by the ORRRC and estimated for the projection years 1976 and 2000. These are given in the following Table 15 for the four activities under consideration in this study.

The table shows a continuing rate of increase in participation for the four activities in 1976 and 2000, except for fishing where the rate of increase in 2000 is lower than that observed for 1976. This may be due to a shift of reference to one activity as opposed to another made possible by future changes in the socio-economic characteristics of the population.

TABLE 15

PRESENT AND FUTURE PARTICIPATION RATES PER PERSON 12 YEARS OLD AND OVER IN THE NORTHEAST U.S.

(JUNE - AUGUST)

	1960	1976		2000	
Activity	Activity Days	Percent Increase* Over 1960	Activity Days	Percent Incerease* Over 1960	Activity Days
Swimming	6.82	33.7	9.12	75.3	11.96
Boating**	1.38	35.9	1.88	78.9	22.47
Fishing	1.76	2.4	1.80	2.3	1.80
Picnicking	2.81	14.1	3.22	27.9	3.59
Total	12.77		16.01		19.82

*Increase due to composite effect of income, education and occupation, place of residence, age and sex, and leisure time available.

**Other than sailing or canoeing

Source: ORRRC Report 26 "Prospective Demand for Outdoor Recreation."

For the total of the four activities, however, it is expected that each person 12 years and over will spend about 16 activity days in 1976, and 20 activity days in the year 2000, as opposed to close to 13 activity days in 1960.

Conclusion

This chapter has presented and projected those factors that are believed to affect recreation demand, in general, and water-oriented recreation demand, in particular. An increase in participation has been noted for each and all the recreation activities within our concern. In addition, an indication of the general trend in participation in water-oriented recreation has been inferred from the analysis of the TVA data.

In the following Phase, the projected participation rates will be used for the actual projection of the demand for swimming, boating, fishing, and picnicking activities in 1976 and 2000 in the study area.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The major concern of this report has been to indentify those factors that affect recreation demand, both manifest and latent, and to project those factors into the future. With respect to the projection model presented earlier in Figure 2, the completion of this report satisfies the first two major steps of the model. These are the total demand projections and their adjustments. The process initially involved the analysis of present participation rates and the indentification of the variables affecting these rates. These have been inter-related by individual sub-models which, in turn, made the estimation of future participation rates possible. The impact of latent rates upon those factors were taken into account and an estimate of future total manifest and latent demand was derived.

The two remaining steps to be carried out (in Phase 2)cover the estimation of the extent to which the Delaware River can meet the projected demand under alternative measures of improvement of the water quality of the river, and the translation of that portion of demand met by the river into monetary benefits.

The complexity of the relationships involved in recreation demand projection has necessitated the subjection of the whole analysis to a stepwise process in the sense that specific analyses were first conducted and conclusions were drawn, and then these conclusions were used as inputs to an analytical framework within which demand relationships were projected. The general framework that governs this approach is the projection model. Its purpose is to provide a comprehensive overview of the intricate relationships met while proceeding from the evaluation of present conditions to the final determination of recreation benefits.

Examination of the present conditions in the study area has led to the conclusion that there is a deficiency in the provision of adequate water-oriented recreation facilities to meet the present demand. Water availability is the central problem to this deficiency since inland waters are limited and the river's waters are inadequate for recreation purpose.

While a number of factors have been identified as they affect the four recreational activities under consideration (swimming, boating, fishing, and picnicking), only a few have been found to be relatively important. These are income, leisure time, proximity of facilities, and age. Each of those factors has been projected and the resulting changes were related to the extent of participation in the recreation activities. Finally a composite effect of the relevant factors was estimated presently and in the projection years. Present and future participation rates for each activity were then derived on the basis of the present and future composite effect.

In general, an increase in the rate of participation is noted for the four activities. Among those activities, the highest rate of increase is observed for boating, followed by picnicking, swimming, and finally fishing. One exception to the rule is evidenced for fishing where the percent increase in the rate of participation in the year 2000 as compared to the 1960 rate, is slightly lower than that projected for 1976 as compared to the 1960 rate also. This actual decline in the rate of participation between 1976 and 2000 is, however, offset by the increase in population to the extent that an equal number of fishing activity days will be generated in 1976 and 2000. This decline is contrasted to an observable doubling of the rate of participation in the other activities in 2000 as compared to that in 1976.

Based on the projected participation rates, Phase 2 will be concerned with actual demand projections in each of the four activities in the study area. Estimates of the portions of demand that could be satisfied by facilities in the study area other than the Delaware River will be made, then discounted from the projected total demand. The remainder could then be viewed as demand that would have to be met either by the river or by some other water source. Comparison of this remainder with the capacity of the river for recreation development under different. DECS water quality improvement levels, would indicate the extent to which the river could be used for each recreational activity. Phase 2 will subsequently conclude with the determination of the recreation benefits derivable from the use of river for recreational purposes under the five alternative levels of water purification of the Delaware River.

APPENDIX A

SOME APPROACHES TO DEMAND ESTIMATION

The purpose of this appendix is to briefly review some previously advanced methods and techniques for measuring the demand for and/or the value of outdoor recreation. As can easily be noticed, approaches are of a rather conceptual character, and in fact, require further empirical evidence before they can be considered operational. For the purpose of orderly presentation the concepts will be presented chronologically, as they were commonly known. This sequence may also assist in a better understanding of the evolution of the definition and interpretation of the concept of outdoor recreation demand over a period of time.

(1) Clawson's Demand Functions[6]

Clawson has suggested that the visitation rate (V) to a recreation facility can be considered, in a simplified form, as a function of the cost (C) associated with travel (time and money) to and use of facility, that is: $V = f(C)$.

To derive the demand curve, assuming equal demand for the facility at each zone, Clawson proposes dividing the study area from which visitors travel to the facility into distance zones with roughly equal population (Clawson recommends ten zones). The rate of visitation from each zone and the average cost for each zone are determined. A curve is drawn by plotting

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[6] Clawson, Marion, Methods of Measuring the Demand for and Value of Outdoor Recreation, Resources for the Future, Inc., Reprint No. 11, February 1959.

V against C. From this curve a true demand curve for the facility can be derived showing the effects of changes in prices and travel cost on absolute number of visitors of a given facility.

Clawson applies this technique to the problem of predicting the use and value of proposed facility through analyzing an existing facility which is similar to the proposed one in its major characteristics.

In an analysis of the demand for boating in Wisconsin, Wood[7] used a modified Clawson technique. His modification is based on the assumption that relative values can be measured by factors which take into account the distances which users are willing to travel (not those which they actually travel) to reach recreation facilities.

Knetsch[8] argued Clawson's assumption of equal demand for the facility at each zone and proposed the incorporation of additional demand factors that would overcome this assumption. He therefore expands the demand relationship by incorporating factors that include income (Y), substitution of other facilities (S), and congestion (G). Thus, his functional relationship is given by $V = f(C,Y,S,G)$.

While the method can be considered a refinement over Clawson's, it is evident that it also depends upon considerable more research into the relationships among those factors of outdoor recreation demand and into their affect upon the use of outdoor recreation facilities.

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[7] Wood, Donald F., "The Distances - Traveled Technique for Measuring Value of Recreation Areas; An Application," Land Economics, Vol. 37, No.4, November 1961.

[8] Knetsch, Jack L., "Outdoor Recreation Demands and Benefits," Land Economics, Vol. 39, No. 4, November 1963.

(ii) Davis' Willingness-to-pay[9]

Davis developed demand curves through the use of the willingness-to-pay technique as contrasted with Wood's willingness-to-travel distance. The demand curve is obtained as a result of a survey in which a representative sample of users is asked to bid for the theoretical privilege of using the outdoor recreation area. Hypothetical prices are raised until the recreationist indicates that he has been priced out of the area. Davis then correlates the demand data with factors such as income and previous experience in the area.

Davis' demand estimations may simulate market conditions better than those of Clawson and Knetsch since they extract data directly from the consumer. A strong argument, however, against this approach is the discrepancy between what the consumer says he is willing to pay and what he will actually pay. This technique is by no means simple or economical; it requires extensive survey and may only be justifiable in the case of a very large or very controversial project where the data are to be acquired in terms of the individual project. Its strength, however, lies in its direct attempt to analyze consumer reaction to changing conditions.

(iii) Foster's Land Productivity[10]

Foster advanced the notion of measuring the productivity of land

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9/ Davis, Robert K., The Value of Outdoor Recreation: An Economic Study of the Maine Woods, unpublished Ph.D. dissertation, Harvard University, 1963.

10/ Foster, John H., "Measuring the Productivity of Land Used for Outdoor Recreation," Land Economics, Vol. 40, No. 3, August 1964.

used for outdoor recreation. He defines the productivity of recreation land as the enjoyment or utility to the users of the land. His proposed measure of productivity is the time spent by users per acre of land available for recreation activities; or

$$P = \frac{VT}{A} \quad \text{where}$$

P	is the productivity of land (visitor hours per acre)
V	person visits per year (number of visits)
T	average length of visit (hours)
A	available area (acres)

As can be readily seen, a major drawback of this measure is that it does not reflect the quality of the recreational experience, a major determinant of total enjoyment.

Foster, however, does not proceed to use the concept of productivity directly for demand estimation purposes. If, for a certain type of operation, land productivity is a stable rate, then the formulation could, of course, be used for estimating the demand that each additional unit of area of the activity could generate; i.e., given P, T, and a certain area A, derive V. The key thus, is the assumption of stability in the rate of land productivity. Empirical verification by Foster in Western Massachusetts shows a substantial variation in land productivity rate among operations of the same type. We may therefore conclude that, as presently formulated, the concept of land productivity is not helpful in outdoor recreation demand estimation.

(iv) Wennergren's Marginal Analysis[11]

Recently Wennergren developed an economic model that provides demand estimates of public recreation. He directly asserts that, contrary to general beliefs, recreation is amenable to traditional economic analysis as much as other marketed commodities. Recreation commodities, as other consumer goods and services, he adds, compete for consumers' income and time resources. The difference lies only in the difficulty in the market pricing of recreation. Wennergren's model hence relies on the basic principles of traditional consumer demand theory. He overcomes the difficulty of market pricing of the commodity by arguing that travel costs to and from a recreation site plus the on-site expenditures constitute the marginal costs of the recreation experience, and thus simulate the role of "price" in the consumption process. Still on a very conceptual level, this model would certainly involve extreme data difficulties. At the same time the pure economic approach that holds the premise of recreation as a consumer good is also debatable.

11/ Wennergren, E. Boyd, "Valuing Non-Market Priced Recreational Resources," Land Economics, Vol. 40, No. 3, August 1964.

(v) Tomazinis' Mean Park Distance

Tomazinis suggested an approach for measuring demand based on a concept termed "mean park distance," or MPD. He views the concept as an indicator of the effect of cost variations in park visits and maintains that recreation demand varies by area and by type of user. The concept was advanced in a recent study [12] on open space in Philadelphia Metropolitan Area. Since then the concept has been further detailed and an account of it is presented in this report. [13] Its application, however, is reserved for the second phase of this study.

Suffice it to mention that the approach relates the proportion of residents in a study area visitng parks on an average summer day to the mean distance between the planning units of the study area and each specific park. Adjustment of this relationship is further made to take into account socio-economic characteristics. This relationship makes it possible to propose alternative MPD's and estimate future demand on this basis. More rigorously, the relationship is given by the function:

r, f(MPD), where:

P: is the percentage of population of a planning unit visiting each park

MPD: average airline distance from the centroid of a planning unit to the centroids of each park.

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[12] Tomazinis, A.R., Metropolitan Open Space from Natural Process, Institute for Environmental Studies, August 1965. See specifically Chapter 5, Demand for Public Recreation Land in the Philadelphia SMSA.

[13] See section on the Availability of Transportation Facilities, Chapter 5, pp. 59-66.

For the purpose of projection we have:

$$A_{t+1} = \frac{n\ P_{t+1}}{n} \quad \text{where}$$

A_{t+1} is the number of acres of parks needed to satisfy the demand in year $t+1$

P_{t+1} population in year $t+1$; and

n number of park users per acre of park, i.e., an assumed capacity standard.

This formulation results in a spatial continuum for the provision of parks. The continuum covers a range from an $MPD_{min.}$ to an $MPD_{max.}$. At $MPD_{min.}$ r is maximum and A is highest, while at $MPD_{max.}$ r is minimum and A is lowest. The optimum MPD would be somewhere in between depending on the case on hand.

There is some difficulty, however, with this concept that stems from the fact that MPD is a measure of the mean value. The same MPD, could imply different spatial patterns of parks. Therefore, while the MPD approach provides a satisfactory measure of demand it does not definitely locate those parks where demand is to be satisfied. A complementary approach could be used to overcome this difficulty. This is the gravity model concept (or any other synthetic model of facility distribution), which will distribute recreation trips to the different existing or proposed recreational areas. The following gravity model formula seems to be appropriate:

$$T_{ij} = P_i \frac{A_j\ F_{ij}\ K_{ij}}{\mathop{}\limits_{x=1}^{n} A_x\ F_{ix}\ K_{ij}} \quad \text{where}$$

T_{ij} recreation trips produced in zone i and attracted to zone j

K_{ij} adjustment factor for zonal interchange

P_i trips produced by zone i

A_j trips attracted by zone j

F_{ij} time-friction factor associated with a trip from zone i to zone j

n number of zones

The trips at destination points (parks) could, then, be estimated on the basis, or as a function, of the capacity of each park.

(vi) Davidson-Adams-Seneca's Cost-Benefit Approach[14]

The authors approach the problem of demand through a cost-benefit analysis of the recreational value of an improvement in water quality. They applied their analysis to the Delaware Estuary but they maintain that their approach would be applicable to other cases. They base their analysis on the premise that ...(unless there is a budgetary constraint) a project should by undertaken whenever the present value of the associated stream of benefits discounted at the appropriate social rate of discount is greater than present costs of the facilities. Costs were identified as opportunity costs of resources at full employment and were assumed to be roughly equal to the money outlays on capital construction.

To estimate benefits, the following steps were followed:

(a) estimation of relationship between total capital costs and the resulting improvement in the quality of water (as measured by dissolved oxygen), then derivation of a marginal cost function.

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[14] Davidson, P., Adams, F.G., and Seneca, J., The Social Value of Water Recreational Facilities Resulting from an Improvement in Water-Quality in an Estuary: The Delaware - A Case Study. Discussion Paper No. 12, Economics Research Service Unit, University of Pennsylvania, 1965.

(b) determination of thresholds for different activities (3, 4, and 5 parts per 1,000 of dissolved oxygen for boating , fishing, and swimming respectively).

(c) estimation of total activity days and marginal activity days for each activity followed by their conversion to present value of total net benefits and marginal net benefits.

(d) maximization of welfare achieved when the quality of the water is improved up to the point where the marginal net benefits equal the marginal net costs.

This study advances interesting notions on three types of externalities: ownership externalities due to the inability to charge for services; technical externalities due to indivisibilities; and public goods externalities due to off-peak demand, option demand, and learning-by-doing factors. These externalities are intimately involved in the market for outdoor recreational activities and are the causes of its market failure. Problems of utilization of other facilities within and without a region, together with problems of data availability in determining the relationships in each of the previously mentioned steps, remain inherent in the approach and may seriously hinder its proper application.

APPENDIX B

PARTICIPATION IN THE DETROIT AREA

The Detroit "Park Users Survey" readily gives information on the percentage of zonal population visiting parks, but only as related to a four-day average visitation, (See Detroit's Appendix V, Table A, Column 3, page 43). The problem was then to find out the change in visitation from that average to that of a summer weekend day. The following steps were carried out to make this computation

1. $vC = V$ where

   v is a vector where v_i represents the number of users (4-day average) going from zone i to all parks (Detroit's Appendix V, Table A, Column 2, page 43),

   C is a matrix where each element C_i^k represents the percent of users from zone i going to park k (Detroit's Appendix V, Table B, page 44),

   V therefore is a matrix where V_i^k is the number of users (4-day average) from zone i going to park k.

   The number of zones under study was 25, $(i = 1, \ldots, n)$; and the number of parks was 8, $(K = 1, \ldots, M)$.

2. Detroit's Appendix III, (B), page 40 gives a breakdown of traffic count made during the survey hours by park and on each of the four survey days (July 4, Thursday, Sunday, and Tuesday). Comparison was made between the traffic count for Sunday and for the four-day average for each park and the percentage increase on Sunday was computed. This is given by vector b where b^k is the percentage increase in traffic count on Sunday over and above

that of the four-day average in park K.

3. $bV = A$ where

b and V as before, and

A is a matrix where A_i^k is the additional number of users from zone i going to park K on a summer Sunday as compared to the four-day average.

4. $U = V + A$ where

U is a matrix where U_i^k is the number of users from zone i going to park K on a summer Sunday.

5. Matrix U is compressed by aggregating row elements so that it becomes a vector u where each element $u_i = \underset{K=1}{\overset{M}{}} U_i^k$ and u_i represents the number of users from zone i going to all parks on a Sunday.

6. Given 1958 population estimates for each zone (Detroit's Appendix V, Table A, Column 1, page 43) in the form of a p vector, vector u is translated to vector $\bar{u}$ where each element $\bar{u}_i$ represents the percentage of population of zone i going to all parks on a summer Sunday, or $\bar{u} = up^{-1} \times 100$.

7. Vector v mentioned in Step 1 above was also translated to vector $\bar{v}$ where each element $\bar{v}_i$ represents the percentage of population of zone i going to all parks on a four-day average basis,

or $\bar{\bar{v}} = vp^{-1} \times 100$. Therefore, vectors $\bar{u}$ and $\bar{\bar{v}}$ are comparable except that the latter is on a four-day average basis, and the former on a summer Sunday basis.

8. The MPD for each zone was computed from Map 2, page 11, using the following equation where the MPD of zone i is given by

$$MPD_i = \frac{\sum_{K=1}^{M} d_i^k}{M} \quad \text{where}$$

d_i^k is the airline distance from the centroid of zone i to the centroid of park k

M is the number of parks

$K = 1, \ldots, M$

9. The accompanying Table 16 was formed in which Column (1) identifies the planning unit zones (Z) as coded in the Detroit Study; Column (2) consecutive enumeration of the zones; column (3) the MPD; Columns (6) and (7) the percentage of zonal population visiting parks (4-day average) or $\bar{\bar{v}}$, and (summer Sunday), or $\bar{u}$. In addition Columns (4) and (5) represent the zonal population density (persons per square mile), and median family income (dollars per year) respectively.

For the total area the number of park users on the four-day average basis amounts to 4.5 percent of the total population, while on the summer

TABLE 16

MPD, DENSITY, INCOME, AND PERCENT PARTICIPATION
(DETROIT)

Planning Units			MPD	Population Density	Median Income	Percentage of Population Visiting Parks	
	Detroit Code	Number	X_1	X_2	X_3	(4-day av.) Y_1	(Sum. Sunday) Y_2
	(1) Z	(2)	(3)	(4)	(5)	(6) $\bar{\bar{v}}$	(7) $\bar{u}$
	1 A	1	21.5	6,045	7,300	3.3	5.5
	1 B	2	22.3	615	6,600	2.0	3.4
I	2	3	26.0	960	6,800	3.0	5.0
	3	4	29.0	126	6,400	1.3	2.2
	4 A	5	18.2	3,925	8,000	3.3	5.2
	4 B+5A	6	18.9	1,831	7,200	1.5	2.1
	5 B	7	23.3	442	7,300	1.3	2.0
II	6 A	8	26.0	245	7,200	0.8	1.5
	6 B	9	26.4	157	7,000	0.7	1.8
	6 C	10	22.0	239	7,000	2.6	5.0
	7	11	15.5	545	7,500	2.4	4.5
	8	12	18.0	2,763	6,800	6.4	13.4
	9 A	13	19.5	3,934	8,000	4.5	8.7
	9 B	14	21.8	310	6,800	1.1	2.3
	9 C	15	22.9	226	6,800	0.6	1.0
III	10 A	16	21.1	5,172	7,000	4.7	8.0
	10 B	17	24.5	964	7,800	2.1	3.5
	11	18	19.2	15,697	6,100	5.6	9.4
	12	19	22.2	4,033	11,700	4.2	6.7
IV	13	20	24.9	537	6,900	1.4	2.6
	14	21	27.8	142	6,000	2.6	4.5
	15	22	33.8	323	6,100	4.8	8.1
V	16	23	43.2	273	5,600	0.8	1.4
	17 A	24	39.4	113	5,600	1.4	2.3
	17 B	25	32.0	93	5,600	0.5	0.8
	TOTAL AVERAGE		24.8	1,856	6,800	4.5	7.7

Sources: Column (3), map measurements (4) and (5), U.S. Census; (6) and (7), computed

Sunday basis it amounts to 7.7 percent with an increase of about 72 percent. The average MPD for all zones in the study area is 24.8 miles.

APPENDIX C

BODIES OF WATER

Delaware	Counties	Water Acres
E.003[15] - Chesapeake and Delaware Canal	New Castle	2,000
A.013 - Brandywine Park	New Castle	3
L.006 - Lumis Pond Wildlife Area	New Castle	200
L.007 - Chesapeake and Delaware Wildlife Area	New Castle	270
W.003 - Becks Pond	New Castle	30
A.010 - n.a.	New Castle	5
A.014 - n.a.	New Castle	2
A.016 - South Brandywine Park (Wilmington)	New Castle	1
A.017 - n.a.	New Castle	1
A.019 - n.a.	New Castle	10
A.009 - n.a.	New Castle	1
A.002 - n.a.	New Castle	1
New Jersey		
Z.387 - Fort Dix Reservation	Burlington	2,000
F.606 - Lebanon State Forest	Burlington	71
F.607 - Bass River State Forest	Burlington	67
F.608 - Wharton State Forest	Burlington	535
F.612 - Penn State Forest	Burlington	90
L.013 - Winslow Public Hunting and Fishing Grounds	Camden	18
L.017 - Rowlands Fish Grounds (Gloucester twp.)	Camden	6
A.037 - New Brooklyn Park	Camden	140
C.054 - Woodlynne Park Area	Camden	2
C.057 - Newton Lake Park	Camden	100
C.049 - Berlin Park Area	Camden	20
C.056 - Newton Creek Area	Camden	5
C.059 - Cooper River Park Area	Camden	1,600
C.034 - Farnam Park	Camden	8
C.060 - Pennypacker-Hopkins Pond	Camden	20
C.061 - Wallworth and Evans Park Area	Camden	50

---

[15] Letter and figures refer to the Bureau of Outdoor Recreation Park Survey coding.

New Jersey (continued)	**Counties**	**Water Acres**
C.062 - Mountwell Park Area	Camden	2
C.058 - Haddon Lake Park Area	Camden	70
A.040 - John A. Roebling Park	Camden	18
C.030 - Fred Sawyer Park	Camden	2
L.034 - Logan Pond	Gloucester	4
A.009 - Round Valley	Hunterdon	2,255
A.027 - Spruce Run Recreation Area	Hunterdon	467
L.009 - Clinton Fishing Grounds	Hunterdon	1
L.019 - Kenneth Lockwood Gorge Public Hunting	Hunterdon	20
L.041 - Amwell Lake	Hunterdon	11
L.042 - Baldwin Lake	Mercer	18
C.069 - Belle Mount Ski-Picnic Area	Mercer	1
C.022 - Stacy Park (Trenton)	Mercer	2
C.026 - Cadwalader Park (Trenton)	Mercer	3
A.006 - Fort Mott State Park	Salem	10
A.011 - Parvin State Park	Salem	107
L.035 - Maskells Mill Fish Grounds	Salem	19
L.036 - Greenwood Fish Grounds	Salem	10
Pennsylvania		
A.085 - Ralph Stover State Park	Bucks	5
A.090 - Washington Crossing State Park	Bucks	5
C.211 - Levittown Lake Recreation Area	Bucks	20
A.024 - Ringing Rock Scenic Park	Bucks	1
A.027 - Churchville Park	Bucks	180
C.104 - Lake Towhee Park	Bucks	50
C.105 - John Stover Tinicum Park	Bucks	2
C.106 - Weisel Park	Bucks	8
C.107 - Tohickon Valley Parks	Bucks	5
C.155 - Playwicki Parks	Bucks	3
C.156 - Mill Creek Park	Bucks	75
L.225 - Icedale Lake Recreation Area	Chester	20
A.038 - Nottingham Park	Chester	30
C.138 - Hibernia Park	Chester	40
A.028 - Cobbs Creek Valley Nature Park (Haverford)	Delaware	2
A.029 - Darby Creek Valley Park (Haverford)	Delaware	3
C.166 - Gillespie Play Area (Upper Darby)	Delaware	4
C.168 - Primos Elementary School (Upper Darby)	Delaware	3
C.170 - Upper Darby Township Park (Upper Darby)	Delaware	1
C.124 - Upper Perkiomen Valley Park	Montgomery	58
C.125 - Lower Perkiomen Valley Park	Montgomery	5

Pennsylvania (continued)	**Counties**	**Water Acres**
A.036 - Pennypack Park	Philadelphia	130
C.110 - Tacony Creek Park	Philadelphia	20
C.112 - Wissahickon Carpenter WD	Philadelphia	135
C.175 - Former Penn State F.H.	Philadelphia	9
C.192 - Burholme Park	Philadelphia	8
C.193 - Cobbs Creek Park	Philadelphia	394
C.197 - Hunting Park	Philadelphia	7
C.199 - Morris Park	Philadelphia	8
C.200 - Franklin D. Roosevelt Park	Philadelphia	10
C.172 - Camp William Penn	Philadelphia	15
		1,246
	Total	11,522

APPENDIX D

BOATING AND FISHING PLACES

Delaware	Counties	Activity[16]
E.003 - Chesapeake and Delaware Canal	New Castle	B
A.002 - Lumis Pond	New Castle	B.F.
A.003 - Augustine Beach Recreation Area	New Castle	B.F.
A.013 - Brandywine Park	New Castle	B
L.006 - Lumis Pond Wildlife Area	New Castle	B.F.
L.007 - Chesapeake and Delaware Wildlife Area	New Castle	B.F.
L.008 - Reedy Island Wildlife Area	New Castle	B
W.003 - Becks Pond	New Castle	B.F.
C.002 - Harmony Hills	New Castle	B.F.
A.015 - North Brandywine Park (Wilmington)	New Castle	B.F.
A.016 - South Brandywine Park (Wilmington)	New Castle	B.F.
n.a. - Appoquinimink Wildlife Area (Odessa)	New Castle	B.F.
A.006 - Todd Estates Park	New Castle	F
A.010 - Banning Park	New Castle	F
A.012 - Woodland Heights Parks	New Castle	F
C.004 - Brookhaven Park	New Castle	F
C.010 - Rockford Park (Wilmington)		
New Jersey		
Z.387 - Fort Dix Reservation	Burlington	B
F.607 - Bass River State Forest	Burlington	B.F.
F.603 - Wharton State Forest	Burlington	B.F.
F.611 - Green Bank State Forest	Burlington	B.F.
F.612 - Penn State Forest	Burlington	B.F.
F.606 - Lebanon State Forest	Burlington	F
A.037 - New Brooklyn Park	Camden	B.F.
C.057 - Newton Lake Park	Camden	B.F.
C.059 - Cooper River Park Area	Camden	B.F.
C.034 - Farnam Parks	Camden	B.F.
C.060 - Pennypacker-Hopkins Pond	Camden	B.F.
C.061 - Wallworth and Evans Park Area	Camden	B.F.
C.062 - Mountwell Park Area	Camden	B
n.a. - Blue Mirror Lake Club (Clementon)	Camden	B.F.
n.a. - Clementon Lake Park (Clementon)	Camden	B

---

[16] B, F stand for boating and fishing.

New Jersey (continued)	Counties	Activity
L.017 - Rowlands Fish Grounds	Camden	F
C.049 - Berlin Park Area	Camden	F
C.051 - Camden Park Area	Camden	F
C.058 - Haddon Lake Park Area	Camden	F
A.040 - Barrington Boro	Camden	F
L.034 - Logan Pond	Gloucester	B.F.
A.009 - Round Valley	Hunterdon	B.F.
A.027 - Spruce Run Recreation Area	Hunterdon	B.F.
L.041 - Amwell Lake	Hunterdon	B.F.
L.009 - Clinton Fishing Grounds	Hunterdon	F
L.019 - Kenneth Lockwood	Hunterdon	F
L.042 - Baldwin Lake	Mercer	B.F.
A.017 - Washington Crossing State Park	Mercer	B.F.
L.024 - Vinnest Refuge	Mercer	B.F.
C.022 - Stacy Park (Trenton)	Mercer	B.F.
C.069 - Belle Mount Ski-Picnic Area	Mercer	F
A.006 - Fort Mott State Park	Salem	F
A.011 - Parvin State Park	Salem	F
L.035 - Haskells Mill Fishing Grounds	Salem	F
L.036 - Greenwood Fishing Grounds	Salem	F
L.037 - Mad Horse Creek Tract	Salem	F
Pennsylvania		
A.027 - Churchville Park	Bucks	B.F.
C.104 - Lake Towhee Parks	Bucks	B.F.
C.105 - John Stover Tinicum Park	Bucks	B.F.
C.155 - Playwicki Park	Bucks	B.F.
C.156 - Mill Creek Park	Bucks	B.F.
C.211 - Levittown Lake Recreation Area	Bucks	F
C.106 - Weisel Park	Bucks	F
C.107 - Tohickon Valley Park	Bucks	F
A.091 - Valley Forge State Park	Chester	B.F.
L.225 - Icedale Lake Recreation Area	Chester	B.F.
A.038 - Nottingham Park	Chester	B.F.
C.128 - Hibernia Park	Chester	B.F.
C.119 - Cleyton Park	Delaware	F
C.157 - Glen Providence Park	Delaware	F

Pennsylvania (continued)	Counties	Activity
A.029 - Darby Creek Valley Park (Haverford)	Montgomery	F
C.124 - Upper Perkiomen Valley Park	Montgomery	B.F.
C.125 - Lower Perkiomen Valley Park	Montgomery	B.F.
C.128 - Alverthorke Park (Abington)	Montgomery	B
L.224 - State Game Land No. 234	Montgomery	F
C.200 - Franklin D. Roosevelt Park	Philadelphia	B.F.
C.112 - Wissahickon Carpenters W.D.	Philadelphia	B.F.
C.175 - Former Penn State F.H.	Philadelphia	B.F.
C.194 - Fairmount Park	Philadelphia	B.F.
A.036 - Pennypack Park	Philadelphia	B.F.
C.172 - Camp William Penn	Philadelphia	B.F.

WATER-ORIENTED RECREATION BENEFITS

A Study

of the Recreation Benefits Derivable
from Various Levels of Water Quality
of the Delaware River

Phase II

Projection of Recreation Demand and Benefits

by
Anthony R. Tomazinis and Iskandar Gabbour

Institute for Environmental Studies
University of Pennsylvania
February 1967

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PREFACE

The research work of the project has been financed by the Public Health Service, Department of Health, Education, and Welfare under contract No. PH 86-65-74. This report covers only Phase II of the research.

The work was carried out within the Institute for Environmental Studies, University of Pennsylvania, under the direction of Dr. Anthony R. Tomazinis, Project Director, and Iskandar Gabbour, Research Associate. Several graduate students of the University of Pennsylvania have contributed to the work of the project as research assistants. Among them are William C. Wheaton, Michael Hallor, and Judith Bronstein. Mrs. Janice Ludman has carried most of the typing load of the project.

CHAPTER I

INTRODUCTION

The purpose of the present study is to estimate the benefits derivable from the use of the waters of the Delaware River for recreational activities. This report is essentially a continuation of a study that was originally divided into two parts. In the first part, or Phase I, the factors affecting recreation demand, both manifest and latent, were identified and estimated for two projection years, 1976 and 2000. Based on the findings presented in Phase I, the work of Phase II was initiated. It is mainly concerned with two related aspects. First, an estimation of both the total recreation demand and the extent to which the Delaware River can meet that demand under alternative water quality improvement plans. Next, the monetary benefits derived from meeting that portion of demand by the river are evaluated and compared.

Four main recreational activities were analyzed in Phase I. These were swimming, boating, fishing, and picnicking. In the present report, the projection of recreation demand for each of the first three activities is undertaken separately and in accordance with a similar conceptual approach. This is the subject matter of the following Chapter II. In Chapter III, specific consideration is given to picnicking activity in the study region,[1] since it involves a choice of alternative locations for park developments along the river. Furthermore, the locations of these parks are analyzed through the application of the mean park distance approach outlined in Phase I. This analysis will result in projections for picnicking demand that would be satisfied by the potential parks to be developed along the river. That portion of future demand satisfied by the river is then added to the future demand estimates for swimming, boating, and fishing that the river may satisfy (presented in Chapter II). A comparative analysis of future demand among the four activities reveals the relative importance, or contribution, of each in relation aggregate demand. Chapter III, therefore, concludes by presenting the aggregate recreation demand(s) for the four activities that the Delaware River may possibly satisfy in the years 1976 and 2000 should the quality of its waters be improved to various levels of purity.

---

[1] See Figure 1, page 2, Phase I for the delineation of the study area.

Chapter IV of this report is concerned with estimating the benefits derivable from the possible participation in each of the four recreational activities under each alternative water quality improvement plan for the two projection years. This is essentially a translation of the demand estimated in Chapter III into monetary benefits. Finally, an aggregation of, and a comparison between, the benefits derivable under each alternative is made. The last chapter of this report, Chapter V, presents a summary of the major findings and conclusions resulting from the total research effort.

CHAPTER II

PROJECTION OF FUTURE RECREATION DEMAND

In this chapter the total demand for swimming, boating, and fishing in the study region in 1960 and in the projection years 1976 and 2000 is first estimated. That portion of demand satisfied by existing or proposed facilities other than the river is then discounted from the total demand. The difference is viewed as demand that would have to be satisfied either by the Delaware River or by some other water source. Comparisons of this remaining portion of demand with the capacity of the river under various plans for water quality levels indicate the extent to which the river could satisfy the needs for facilities for one or more of the outdoor recreation activities discussed in this project.

The following estimates are divided into projections of total participation rates in the study region which will be followed by the actual estimation of the demand to be satisfied by the Delaware River. This corresponds to the third section of the projection model entitled "River Contribution".[2]

Future Total Participation Estimates

In Chapter VI of the report on Phase I of this project, the rates of participation in the four activities under study were projected in terms of activity days (See Table 15, page 79, Phase I). An alternative indicator of demand, in terms of the percent of persons 12 years old and over participating in the four activities is presented in Table 1 below.

---

[2] See Figure 2, page 16, Phase I.

TABLE 1

PRESENT AND FUTURE PERCENT OF PERSONS 12 YEARS OLD AND OVER PARTICIPATING IN THE NORTHEAST U.S. (JUNE-AUGUST)

Activity	Year		
	1960	1976	2000
Swimming	45	55	63
Boating	22	28	38
Fishing	29	32	36
Picnicking	53	57	61

Source: ORRRC Report 26, "Prospective Demand for Outdoor Recreation."

Assuming that the proportion of persons 12 years and over will remain at the same level as in 1960, i.e. 78 percent (3.93 million) of the total population, then the total number of persons 12 years and over in our study region will be 4.98,and 6.63 millions in 1976 and 2000 respectively. Multiplying the rates of activity days per participant (See Table 15, page 79, Phase I) by the number of participants, one can estimate the total number of activity days which represents the demand for such activities at any given time. Table 2 presents the results of this estimation.

TABLE 2

PRESENT AND FUTURE ACTIVITY DAYS IN MILLIONS IN THE STUDY REGION

Activity	Year 1960	1976	2000
Swimming	26.8	45.4	79.3
Boating	5.4	9.4	16.4
Fishing	6.9	9.0	11.9
Picnicking	11.0	16.0	23.8

Source: Table 1

These estimates of total number of activity days projected for 1976 and 2000 for the four activities indicate the expected future total demand for those activities. A portion of this demand will be satisfied within the area, by the Delaware River or otherwise, and the rest outside the study area, perhaps on the New Jersey shore or at Tocks Island.

For the purpose of our study, it is necessary to derive the demand for each activity (in activity days) that could be satisfied by the Delaware River under alternative plans of improvements of the quality of the river's waters. The Delaware Estuary Comprehensive Study (DECS), the parent study of this research project, has produced five basic alternative sets of plans for the treatment of the waters of the Delaware River. These alternatives involve the improvement of the quality of the water in different sections of the river (DECS identified 30 sections) to various degrees of purity according to several criteria. In some sections water contact recreation will be possible while in others only non-water contact types of recreation will be allowed. Figures 1 to 5 show the five alternatives objective sets (OS) and the type of recreational activities possible for each section of the river.

Objective Set I (OS I)[3/] provides the greatest increase in water use and water quality. Water contact recreation is indicated in the upper and lower reaches of the estuary. Sport fishing is placed at a relatively high level consistent with the make-up of the region. In addition, anadromous fish passage is included as a definitive part of the water quality management program.

Objective Set II (OSII) reduces the area of water contact recreation from that of OS I. Dissolved oxygen is also reduced and results in a concomitant reduction in sport fishing. Anadromous fish passage is, however, maintained as in OS I.

Objective Set III (OS III) is similar in all respects to OS II except for the following changes. First, the specific dissolved oxygen criteria for anadromous fish passage are not imposed. Second, a general decrease in the sport fishing potential is imposed through a lowering of the dissolved oxygen requirements.

Objective Set IV (OS IV) represents a slight increase over present levels in water contact recreation and fishing in the lower reaches of the estuary. Generally, quality requirements are increased slightly over 1964 conditions, representing a minimally enhanced environment.

[3/] See DECS "Preliminary Report and Findings", July 1966, pp. viii-ix.

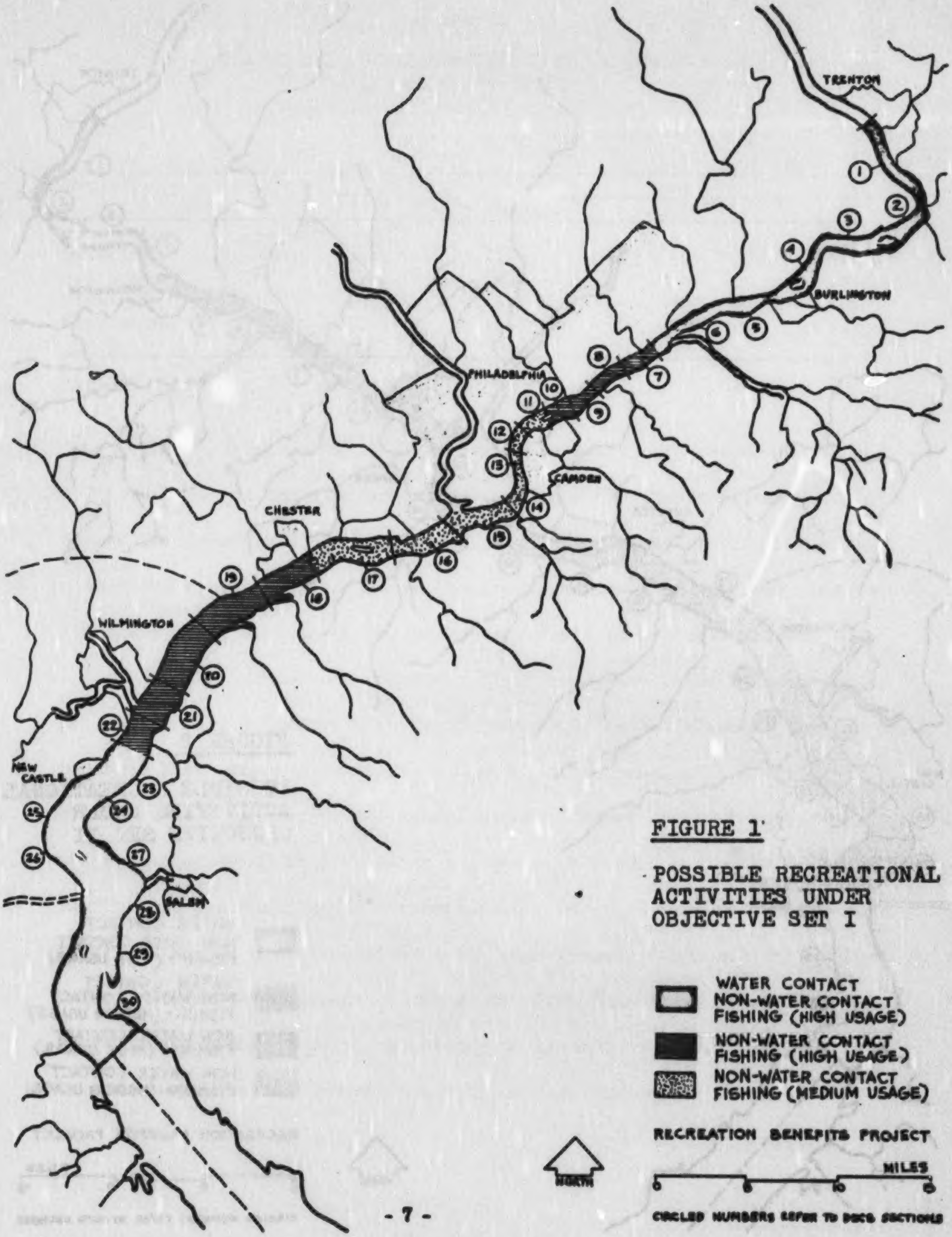
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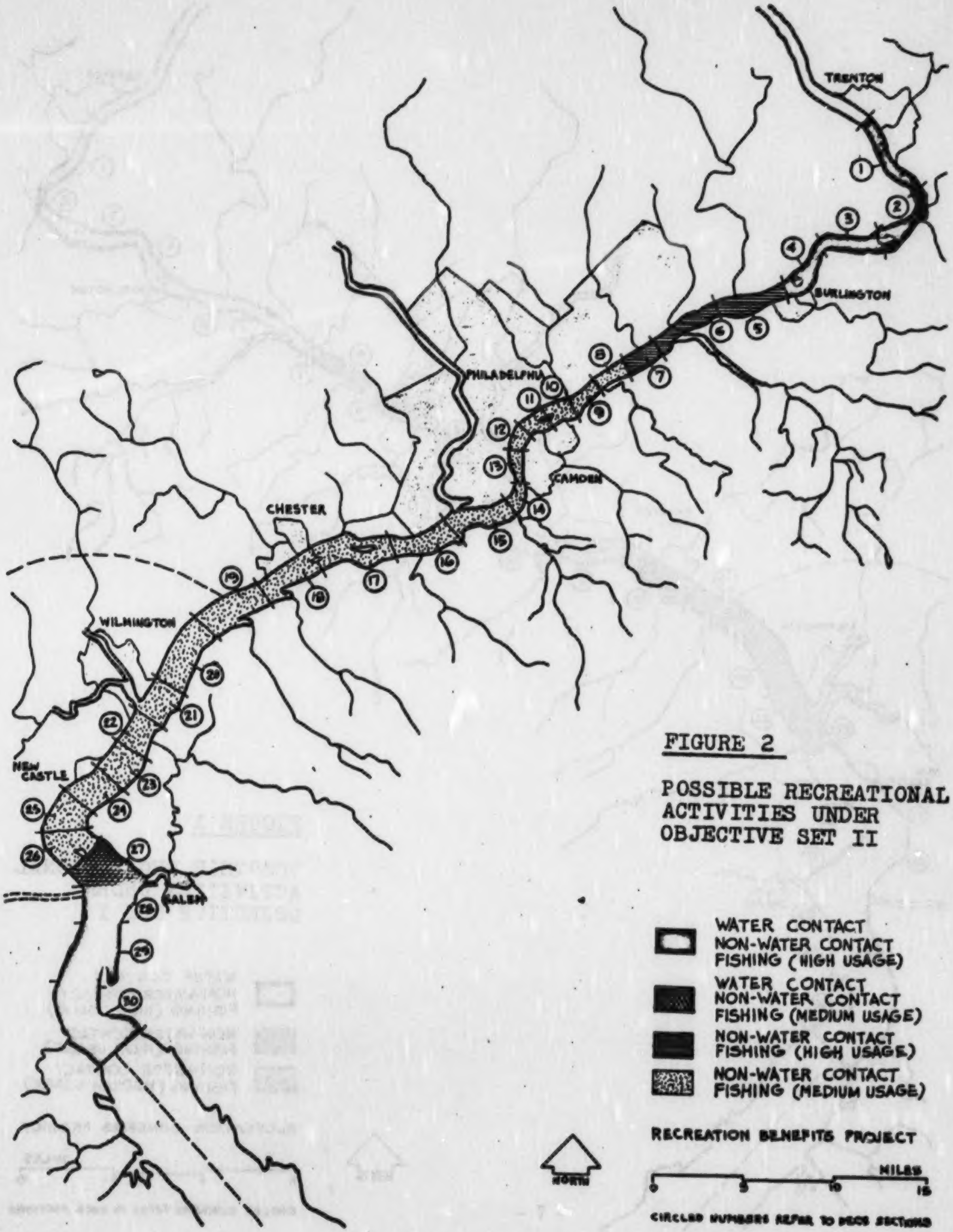
FIGURE 1

POSSIBLE RECREATIONAL
ACTIVITIES UNDER
OBJECTIVE SET I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WATER CONTACT NON-WATER CONTACT FISHING (HIGH USAGE)
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FIGURE 2

POSSIBLE RECREATIONAL ACTIVITIES UNDER OBJECTIVE SET II

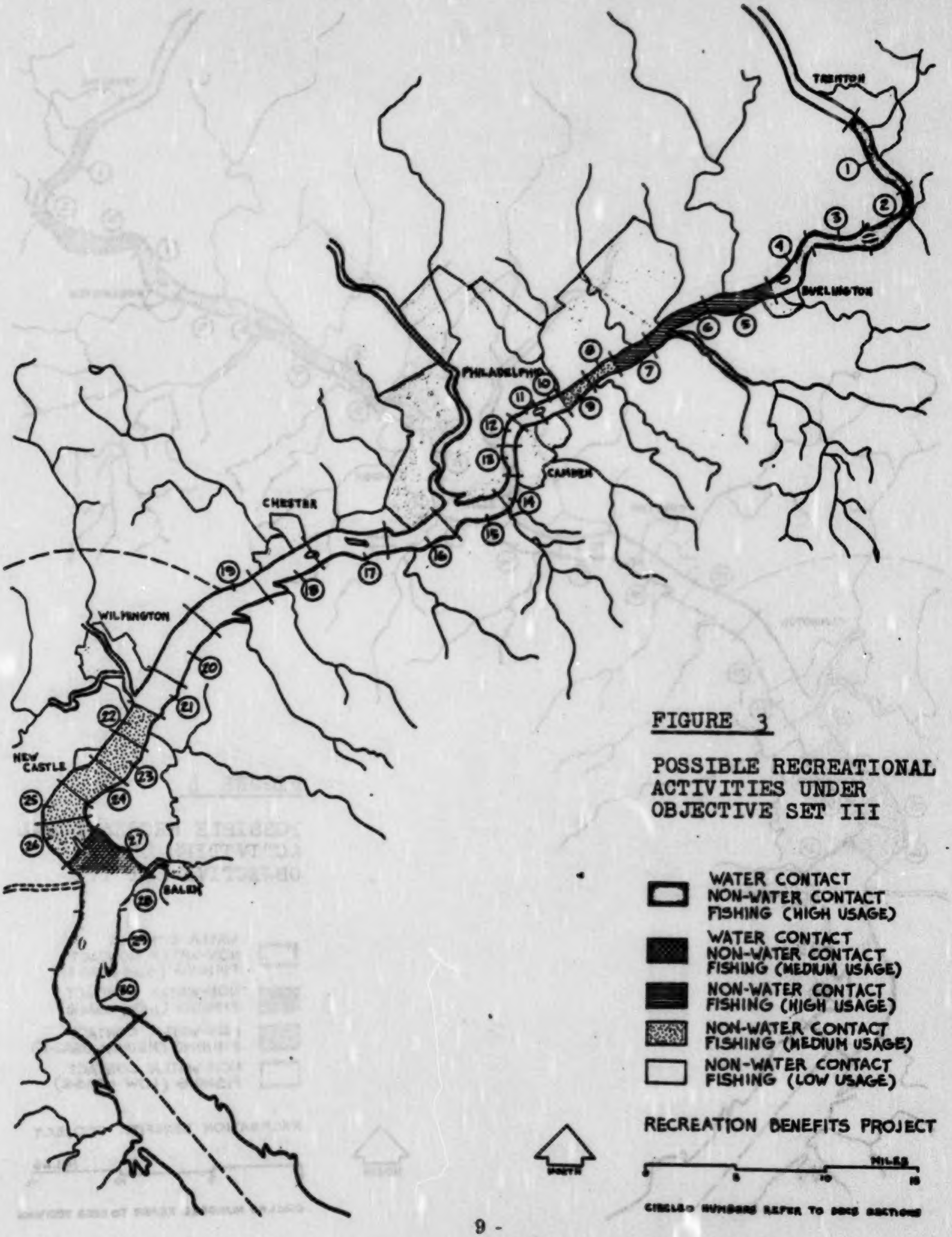
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FIGURE 3

POSSIBLE RECREATIONAL ACTIVITIES UNDER OBJECTIVE SET III

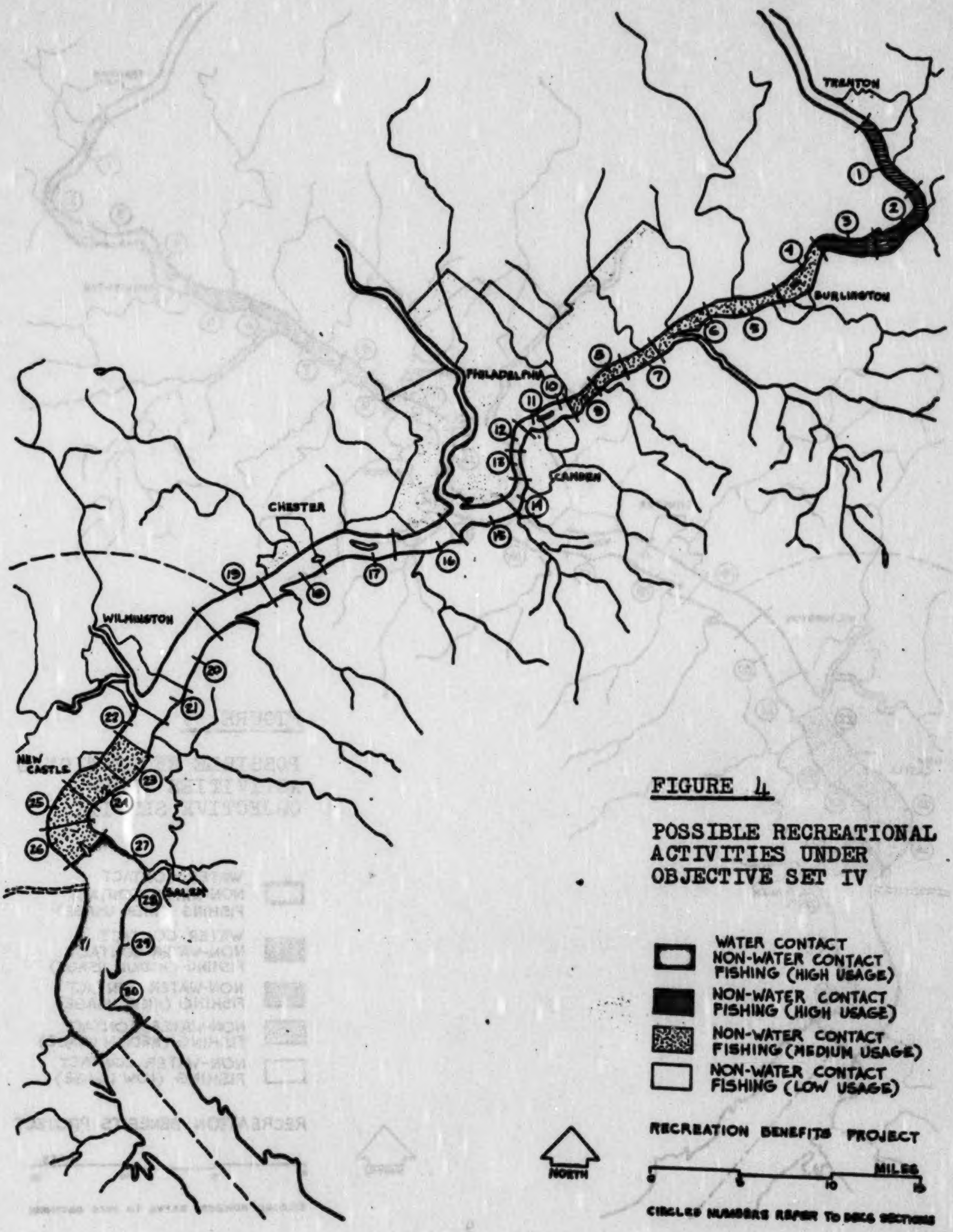

FIGURE 4

POSSIBLE RECREATIONAL ACTIVITIES UNDER OBJECTIVE SET IV

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NON-WATER CONTACT FISHING (MEDIUM USAGE)
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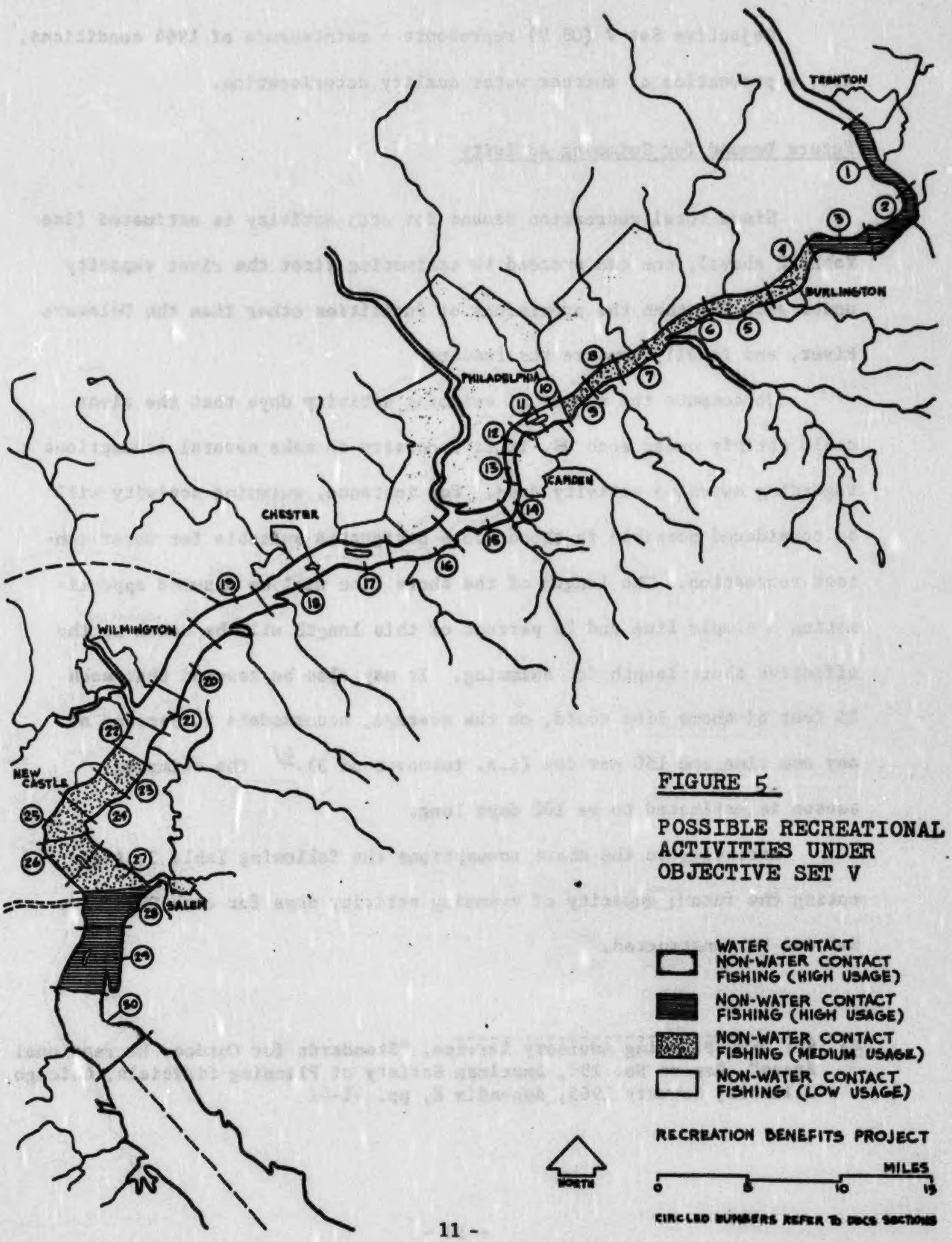
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☐ NON-WATER CONTACT FISHING (LOW USAGE)
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FIGURE 5.

POSSIBLE RECREATIONAL ACTIVITIES UNDER OBJECTIVE SET V

Objective Set V (OS V) represents a maintenance of 1964 conditions, i.e. a prevention of further water quality deterioration.

Future Demand for Swimming Activity

Since total recreation demand for each activity is estimated (See Table 2 above), one can proceed in estimating first the river capacity under each OS, then the provisions of facilities other than the Delaware River, and finally compare the results.

To compute the number of swimming activity days that the river could satisfy under each OS, it is necessary to make several assumptions regarding swimming activity days. For instance, swimming activity will be considered possible in those areas designated suitable for water contact recreation. The length of the shore line will be assumed approximating a simple line and 25 percent of this length will be taken as the effective shore length for swimming. It may also be assumed that each 25 feet of shore line could, on the average, accommodate 50 persons at any one time and 150 per day (i.e. turnover of 3).[4] The swimming season is estimated to be 100 days long.

According to the above assumptions the following Table 3, indicating the future capacity of swimming activity days for each Objective Set can be constructed.

---

[4] See ASPO Planning Advisory Service, "Standards for Outdoor Recreational Areas", Report No. 194, American Society of Planning Officials, Chicago, Illinois, January 1965, Appendix E, pp. 41-42

TABLE 3

RIVER CAPACITY FOR SWIMMING BY OBJECTIVE SET

O.S.	Shore Length (feet)	Effective Shore Length (feet)	Number of 25' Sections	Activity Days Per Day	Total Activity Days
I	320,100	280,025	3,201	480,150	48.0×10^6
II	198,900	49,725	1,989	298,350	29.8×10^6
III	198,900	49,725	1,989	298,350	29.8×10^6
IV	55,000	13,750	550	82,500	8.25×10^6
V	26,400	6,600	264	39,600	3.96×10^6

In order to estimate that portion of demand which might be satisfied in our study area by facilities other than the Delaware River, use is made of the average daily attendance figures observed for all swimming places in the area. If we apply the 1960 average rate of swimming pool[5/] availability of 0.12 pools per 1,000 population found the five Pennsylvania counties (see Table 2, page 24, Phase I) to all the study area, we find that in 1960, about 600 swimming pools were available within the study area (compared to 414 in the five Pennsylvania counties only).

[5/] Swimming pools constitute the vast majority, 98 percent, of non-river swimming facilities within the study area.

Average daily attendance figures have shown that, in general, each swimming place accounts for 180 activity days per day, in 1960.[6] The total number of swimming activity days in 1960 in the study area satisfied by non-river facilities was therefore equal to 180 x 100 x 600 = 10.8×10^6. If, for 1976 and 2000 we apply the projected rate of pool availability in the five Pennsylvania counties, or 0.33 pools per 1,000 total population,[7] to the entire study area, then the number of swimming places which may be expected to be available in 1976 and 2000 would be 2,075 and 2,800 pools respectively. Swimming pool attendance may also be expected to increase as the percentage of total population participating in swimming increases. Previous analysis indicates that this increase might be from 41 percent from 1960 to 1976, and 22 percent from 1960 to 2000. If similar increases prevail in terms of attendance, then average daily attendance would account for about 200 activity days in 1976 per pool. Total activity days in 1976 then would be 200 x 100 x 2,075, or 41.5×10^6. Similarly, for the year 2000 the average daily attendance would be about 220 activity days per pool. As a result, total activity days in 2000 then would be 220 x 100 x 2,800, or 61.3×10^6, satisfied by facilities other than the Delaware River.

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[6] As shown in page 26, Phase I, of this research project.

[7] See the discussion in Chapter IV, Phase I.

Comparing the estimates for total demand for swimming with the extimates for the demand satisfied by facilities other than the Delaware River, we can obtain an estimation of the demand that would have to, or can, be satisfied either by the river (if the quality of its water is improved) or elsewhere. The demand expected to be satisfied by the river itself could be calculated for each case by comparing the previously estimated capacity of the river for each objective set with the total unsatisfied recreation demand, after having subtracted the capacity and use of non-river facilities. This comparison is shown in Table 4.

Table 4 shows, for example, that while total demand for the area will be in the order of 79.3 million activity days in the year 2000, approximately 61.3 million of those swimming activity days will be satisfied by means other than the river, i.e. in pools and inland beaches. The remaining demand of 18 million swimming activity days can easily be met by any of objective sets I, II, or III, since the capacity of the river under these alternative plans far exceeds the available demand. However, out of those 18 million activity days only 8.25 and 3.96 million can be satisfied by objective sets IV and V respectively, since these represent the only capacity these alternatives have for swimming activities. In these cases the excess recreation demand would have to be met by facilities located outside our study area, such as the New Jersey shore or Tooks Island project.

Future Demand for Boating Activity

A similar procedure is followed in projecting the boating recreation demand that might be satisfied by the Delaware River under each alternative development plan. However, the projection of demand for

TABLE 4

POSSIBLE DEMAND FOR SWIMMING IN MILLIONS OF ACTIVITY DAYS
BY OBJECTIVE SET

A			B			C=A-B			D	E			O.S.
1960	1976	2000	1960	1976	2000	1960	1976	2000		1960	1976	2000	
									48.0	-	3.9	18.0	I
									29.8	-	3.9	18.0	II
26.8	45.4	79.3	10.8	41.5	61.3	16.0	3.9	18.0	29.8	-	3.9	18.0	III
									8.25	-	3.9	8.25	IV
									3.96	3.96	3.9	3.96	V

A = Total demand, see Table 2 above
B = Demand satisfied outside Delaware River
C = Demand to be satisfied by river or other, (C=A-B)
D = Capacity of Delaware River, see Table 3 above
E = Demand satisfied by Delaware River (if C D, the river will be used to its full capacity D; if C D only a portion C of the river;s capacity will be used).

boating recreation activity requires that a distinction be made among the various recreation activities that are associated with boating itself. This distinction is of significance in estimating recreation demand per se, and in estimating the benefits derived from satisfying this demand under each alternative plan, as will become evident in a subsequent chapter.

In stretches of the river where water contact recreation would be possible, boating may include pleasure boating, plus sport fishing and swimming. In other parts of the river where the quality of the water may be improved to allow only non-water contact recreation activities and high-usage sport fishing, pleasure boating and sport fishing only might be possible. Finally, pleasure boating only would be possible in those sections of the river where only non-water contact recreation activities, and medium-sage sport fishing are feasible. These three cases are designated B_3, B_2, and B_1 respectively.

Each section of the river was delineated by the DECS for each of the five alternative plans under consideration (see Figures 1 to 5), and the possible recreation activities in each section were determined. If one measures the water acreage of each section, and applies some acceptable empirically derived standards[8] such as one acre per boat for pleasure boating, fishing and swimming, and 5 acres per boat for pleasure boating and fishing, or pleasure boating only, then we may be able to translate the water acreage into number of boats which can be accommodated by the river in each case. Also, accepting another set of standards such as 4 activity days per boat per day,[9] the number of boats can be converted into activity days. The total number of activity days per year can then be derived by multiplying the daily activity days by 30 days, the average duration of the boating season. Table 5 presents this information in detail for the five objective sets.

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[8] See ASPO Planning Advisory Service, op. cit. pp. 21-23.

In order to estimate the capacity of future boating facilities within and about the study area, but other than the river, use is made of the various projections of the responsible agencies in the region. According to those proposals, discussed in more detail in Chapter IV of Phase I, the total inland, non-river water recreation acreage that would be developed for boating would be about 24,000 acres in 1976 and only about 25,000 acres by the year 2000. Half of this water acreage is part of the proposed Tocks Island project. Using the same empirical standards of recreation capacity, length of season, etc., utilized earlier, we can find that these other inland waters may account for 1.4, 2.9, and 3.1 million activity days in the years 1960, 1976, and 2000 respectively.

If we subtract from the total demand for boating, estimated earlier in this chapter, that portion of demand satisfied by inland waters outside the Delaware River, we could derive the remainder portion of demand that would have to be satisfied either by the river or by some alternative source. This latter portion, when compared with the capacity of the Delaware River in meeting boating demand estimated in Table 5 below, enables one to calculate that part of the total boating demand expected to be satisfied by the river under each of the five alternative levels of

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[9] See Pennsylvania Department of Health, "Clean Streams", No. 69 2nd. Quarter

TABLE 5

RIVER CAPACITY FOR BOATING BY OBJECTIVE SET

O.S.	Boating Activity	Water Acreage	Number of Boats		Activity Days Per Day	Activity Days Per Year	Total Activity Days
I	B1	7,617	1,500	32,900	6,000	180,000	4.0×10^5
	B2	18,263	3,700		14,800	444,000	
	B3	27,720	27,700		110,800	3,324,000	
II	B1	30,224	6,000	27,300	24,000	720,000	3.3×10^6
	B2	2,576	500		2,000	60,000	
	B3	20,800	20,800		83,200	2,496,000	
III	B1	11,360	2,400	23,700	9,600	288,000	2.9×10^6
	B2	2,576	500		2,000	60,000	
	B3	20,800	20,800		83,200	2,496,000	
IV	B1	13,677	2,800	21,600	11,200	336,000	2.6×10^6
	B2	1,652	300		1,200	36,000	
	B3	18,526	18,500		74,000	220,000	
V	B1	16,914	3,400	11,600	13,600	408,000	1.4×10^6
	B2	10,881	2,200		8,800	264,000	
	B3	6,061	6,000		24,000	720,000	

water quality improvement. Table 6 presents the results of those calculations.

The table clearly shows that under any of the five objective sets considered, the Delaware River would not be able to meet the total demand for boating recreation activities within the region in the projection years 1976 and 2000. Even at present, the available facilities provide a capacity less than the estimated demand (less by 2.6 million activity days). As can be observed, the demand for boating, in general, in 1976 will be one and one-half times that of 1960, and will experience more than a threefold increase by the year 2000. This level of present demand for fresh water boating activities is, in fact, about 3 times the current supply. A similar ratio between demand and expected supply is maintained in the future, under each alternative plan. Without the provision of these river facilities the ratio of demand over supply of facilities in the region will tend to further increase beyond the present level. In fact, it appears that the only way to come close to meeting that large demand for fresh water boating is by complete purification of the Delaware River, or other major lake developments in and about the region.

Future Demand for Fishing Activity

To estimate the number of fishing activity days that the Delaware River could offer under each of the five objective sets, it is necessary to measure the length of shore for each of the study sections of the river where high-usage sport fishing[10] will be possible. Only those parts of

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[10] "High-usage" sport fishing defines a 90-95 percent survival rate of anadromous fish passage.

TABLE 6

POSSIBLE DEMAND FOR BOATING IN MILLIONS OF ACTIVITY DAYS BY OBJECTIVE SET

A			B			C=A-B			D	E			O.S.
1960	1976	2000	1960	1976	2000	1960	1976	2000		1960	1976	2000	
5.4	9.4	16.4	1.4	2.9	3.1	4.0	6.5	13.3	4.0	-	4.0	4.0	I
									3.3	-	3.3	3.3	II
									2.9	-	2.9	2.9	III
									2.6	-	2.6	2.6	IV
									1.4	1.4	1.4	1.4	V

A = Total demand, see Table 2 above
B = Demand satisfied outside Delaware River
C = Demand to be satisfied by river or other, (C=A-B)
D = Capacity of Delaware River, see Table 5 above
E = Demand satisfied by Delaware River (if C D, the river will be used to its full capacity D; if C D only a portion C of the river's capacity will be used).

the river banks that are accessible, that are not blocked by industry, and that have satisfactory shore conditions can be considered for these purposes. Both sides of the river must, of course, be taken into consideration. From empirical findings a "clustering" effect is also taken into account in order to estimate more accurately what may be called the "usable length" of the river banks. The usable length of shore was found to be approximately 66 percent of the total measured suitable shore length.

The number of persons participating in fishing per day can be estimated using an empirical average spacing between anglers of 10 feet along the usable shore length and a turnover of 2 users per day. These figures were then converted into activity days per year on the basis of an average of 20 activity days per year per angler.[11] The figures pertaining to this analysis are shown in Table 7 below.

TABLE 7

RIVER CAPACITY FOR FISHING BY OBJECTIVE SET

O.S.	Length of Shore (feet)	Usable Shore Length (feet)	Number of Anglers Per Day	Activity Days Per Year
I	437,800	292,000	58,400	1.17×10^6
II	254,700	170,000	34,000	0.68×10^6
III	254,700	170,000	34,000	0.68×10^6
IV	150,200	100,000	20,000	0.40×10^6
V	145,800	97,000	19,400	0.39×10^6

The amount of fishing taking place at present in waters other than the Delaware River has been estimated at about 1.6 million activity days per year.[12] No substantial change is expected in this amount in the projection years beyond a modest increase of 0.2 million activity days between the amount of participation in 1960 and 1976, and again as much between 1976 and 2000. Repeating the procedure followed in the case of swimming and boating, it can be seen that the difference between these figures (1.8 and 2.0 million activity days) and those expressing total demand (estimated earlier in Table 2 of this chapter) would, of course, represent the amount of participation that could be satisfied by the Delaware River. Following the format of Tables 4 and 6 for swimming and boating, Table 8 presents the estimations for fishing activity days that each alternative objective set of river development may provide for in the years 1976 and 2000.

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[11] See ORRRC Report 7, "Sport Fishing--Today and Tomorrow", and California Recreation Plan, Part I, pp. 52-57.

[12] With 33,500 acres of inland water available (see Chapter IV, Phase I), and using the same empirical standards presented above, we obtain a "usable length" of shore of about 400,000 feet, 80,000 anglers per day, and 1.6 million activity days per year.

Besides the actual estimates of fishing demand which can be satisfied by each objective set, the table shows again that even under the best condition of alternative plans, (O.S.I.), where an estimate of 1.17 million activity days could be available for fishing, this river capacity will still be far less than the actual total demand left to be satisfied by the river facilities or other fishing facilities within or about the study area.

TABLE 8

POSSIBLE DEMAND FOR FISHING IN MILLIONS OF ACTIVITY DAYS BY OBJECTIVE SET

A			B			C=A-B			D	E			O.S.
1960	1976	2000	1960	1976	2000	1960	1976	2000		1960	1976	2000	
									1.17	-	1.17	1.17	I
									0.68	-	0.68	0.68	II
6.9	9.0	11.9	1.6	1.8	2.0	5.3	7.2	9.9	0.68	-	0.68	0.68	III
									0.40	-	0.40	0.40	IV
									0.39	0.39	0.30	0.39	V

A= Total demand, see Table 2 above
B= Demand satisfied outside Delaware River
C= Demand to be satisfied by river or other, (C=A-B)
D= Capacity of Delaware River, see Table 7 above
E= Demand satisfied by Delaware River(if C D, the river will be used to its full capacity D; if C D only a portion C of the river's capacity will be used).

SUMMARY AND CONCLUSION

The following Table 9 summarizes the number of activity days that the improvement of the quality of water of the Delaware could generate under the five DECS alternative improvement plans and for the three activities under consideration in the years 1976 and 2000.

TABLE 9

FUTURE PARTICIPATION IN WATER-ORIENTED RECREATION ACTIVITIES IN MILLIONS OF ACTIVITY DAYS BY OBJECTIVE SET

O.S.	Swimming		Boating		Fishing		Total	
	1976	2000	1976	2000	1976	2000	1976	2000
I	3.9	18.0	4.0	4.0	1.17	1.17	9.07	23.17
II	3.9	18.0	3.3	3.3	0.68	0.68	7.88	21.98
III	3.9	18.0	2.9	2.9	0.68	0.68	7.48	21.58
IV	3.9	18.25	2.6	2.6	0.40	0.40	6.90	11.25
V	3.9	3.96	1.4	1.4	0.39	0.39	5.19	5.75

Source: Columns E of Tables 4, 6, and 8 above.

The table demonstrates the gradual increase in the total number of activity days for the three activities from those derived under objective set V to those derived under objective set I in the years 1976 and 2000. For 1976 the increase is from about 5 to 9 million activity days while for the year 2000 it is from about 6 to 23 million activity days. The increse in participation under objective set I becomes more evident in the long run. It is interesting to note the closeness of the figure on total activity days under objective sets II and III. This observation leads one to conclude that as far as those three water-oriented activities are concerned, objective sets II and III seems to be very similar with regard to their capacity to satisfy the future demand for the three activities.

A clearer picture may emerge with the incorporation of picnicking activity that could be satisfied by the development of the river. This analysis as well as the choice of potential locations for park development along the river is the focus of the following chapter.

CHAPTER III

PROJECTION OF FUTURE RECREATION DEMAND FOR PICNICKING

The inclusion of picnicking in this study is a direct result of the belief that the development of major parks at favorable locations along the river is necessary for an extensive undertaking of the three water-oriented recreational activities discussed in the previous chapter. In this sense, the parks and picnic areas would serve as starting points for boat launching ramps, marinas, swimming and fishing activities. Such a comprehensive park system would offer, therefore, a complete package of recreational choices available to the population at specific locations.

The locational choice of these parks involves two aspects. First, these parks should, of course, be located in accordance with the proposed sections for water quality improvements in the five objective sets. Further, the optimality of the chosen locations should be checked. This will be made through the application of the method, discussed earlier in Phase I, that relates the mean park distance (MPD) for each sub-area in the study region of the proportion of the population in each sub-area using the park system.

The benefits that the inclusion of general parks and picnic areas offers are, of course, of major and much more generalized significance. These parks not only provide for an increase in the general availability of facilities for outdoor recreation, but their effect is further felt on the overall quality of the urban environment in the region. This would be achieved through the reclamation of the river front for public use, the purification of the air, the visual-aesthetic level of appreciation, and the economic enhancement of the neighboring area as a whole.

General Approach

Examination of the existing parks available for general outdoor recreation and picnic activities within the study area reveals that their total acreage is in the order of 24,000 acres, of which 18,630 acres are regional parks. This acreage corresponds to an overall regional average of five acres per 1,000 population in 1960. The majority of this land (12,000 acres) is county-owned, while a portion of about 8,000 acres is state- or federally-owned. The remainder of 4,000 acres is owned by the local municipalities. The relative availability of these parks by county in terms of acres per 1,000 population in the study area is given in the following Table 10.

TABLE 10

TOTAL PARK ACRES PER 1,000 POPULATION BY COUNTY: 1960

Salem Co., N.J.	19.2	Camden Co., N.J.	5.6
Chester Co., Pa.	11.1	Philadelphia Co., Pa.	4.0
Bucks Co., Pa.	8.7	New Castle Co., Del.	3.2
Montgomery Co., Pa.	8.4	Delaware Co., Pa.	1.5
Hunterdon Co., N.J.	7.9	Burlington Co., N.J.	0.1
Mercer Co., N.J.	5.9	Gloucester Co., N.J.	0.1

Note: For the five Pennsylvania counties in the study area the estimate is 5.1 acres per 1,000 population. For the New Jersey counties the same estimate is 4.7 acres, while in Delaware it is 3.2 acres.

Source: Acres per 1,000 population derived from the ORRRC Report 21, "The Future of Outdoor Recreation in Metropolitan Regions," Volume II, "Outdoor Recreation and the Megalopolis," and Ann Louise Strong, "Open Space in the Penjerdel Region: Now or Never," Penjerdel, Philadelphia, Pennsylvania, 1963.

Compared with typically recommended standards [13] for recreation land per 1,000 persons, these figures seem low indeed. The National Recreation Association (NRA) recommends a standard of 10 acres of regional parks and 10 acres of municipal parks per 1,000 population for recreation in a region. The New York Regional Plan Association recommends that 25 percent of the land in a region be left open. This land should include 10 acres of local parks for every 1,000 persons as well as 12 acres per 1,000 persons of county parks or 5 percent of the county land area, whichever is greater. The Philadelphia City Planning Commission in turn suggest as necessary a rate of 21 acres of regional parks per 1,000 persons.

In order to meet the NRA-recommended standard, the acreage of parkland in the study area would have to double, even in 1960. Without any improvements to the standards, i.e., just to retain them, the 24,000 acres would have to triple by the year 2000. To achieve the Regional Plan Association standards, the region should have available 50,320 acres, 63,880 acres, and 85,020 acres of local parks, as well as 160,000 acres of county parks in 1960, 1976 and 2000 respectively. In addition, areas amounting to 589,680 acres, 576,120 acres, and 554,980 acres of county or state parks should be kept open in the years as above. Even the more reasonable standards proposed by the Philadelphia City Planning Commission would require the availability of 105,672 acres, 134,148 acres, and 178,542 acres of regional parks in 1960, 1976 and 2000 respectively, in order to be achieved.

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[13] See ASPO Planning Advisory Service, "Standards..." op.cit.

The achievement of such standards seems, at the present time at least, exceedingly unrealistic. Also, the simple objective of achieving overall rates of parkland to the regional population leaves much to be desired, especially in terms of locating the potential parkland within the region and balancing the actual demand for such facilities with the planned supply. Within the present framework it may, therefore, be more appropriate if a realistic effort is made instead of achieving these objectives. In any case, such increases in acreage requirements would have to be met not by park improvements or fragmentary additions to existing parks, but only through major efforts for comprehensive park development, such as along the Delaware River. Only such an extensive effort will meet the needs which will be created due to the population growth on the one hand, and the increase in participation rates in picnicking on the other (from 2.81 activity days per person 12 years and over in 1960, to 3.21 in 1976, and 3.59 in the year 2000).[14/] If one adds to these expectations the projected increase in the proportion of the population 12 years and over participating in picnicking from 53 percent in 1960, to 57 percent in 1976, and 61 percent in 2000, it can easily be seen why the projected total demand for picnicking would increase from 11.0 to 16.0, and up to 23.8 million activity days in 1960, 1976 and 2000 respectively, as was previously estimated.

Developing a number of comprehensive regional parks at strategic locations along the Delaware Estuary (after purification) would be directly usable shore on both sides of the estuary, the width of the river, and the

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[14/] See Table 15, page 79, Phase I.

water acreage available. The following Table 11 presents the results of one such estimation.

TABLE 11

CHARACTERISTICS OF POTENTIAL PARK LOCATIONS ALONG THE DELAWARE ESTUARY

Section	Length of Usable Shore Pennsylvania	Length of Usable Shore New Jersey	Width of River(feet)	Water Acreage	Proposed Park Acreage
1	20,000	20,000	990	455	1,000
3	18,600	14,600	1,410	645	1,350
6	16,800	15,200	2,700	1,240	1,500
27	2,000	2,400	14,100	3,235	2,500
30	6,400	20,000	13,200	6,060	3,200

According to Table 11, under Objective Set I, approximately 9,550 acres of park development would be possible; under Objective Sets II or III 8,050 acres; under Objective Set IV, 5,700 acres; and under Objective Set V, only 3,200 acres can be proposed.

To translate the park acreage into picnicking activity days, a standard proposed by NRA [15] is used. NRA suggests that 100 acres of park would serve a population beneficial to the residents of the region not only because of their central location in relation to the region as a whole, but also due to their association with the largest body of water available in

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[15] See ASPO Planning Advisory Service, "Standards..." op.cit. Table 7, p. 14.

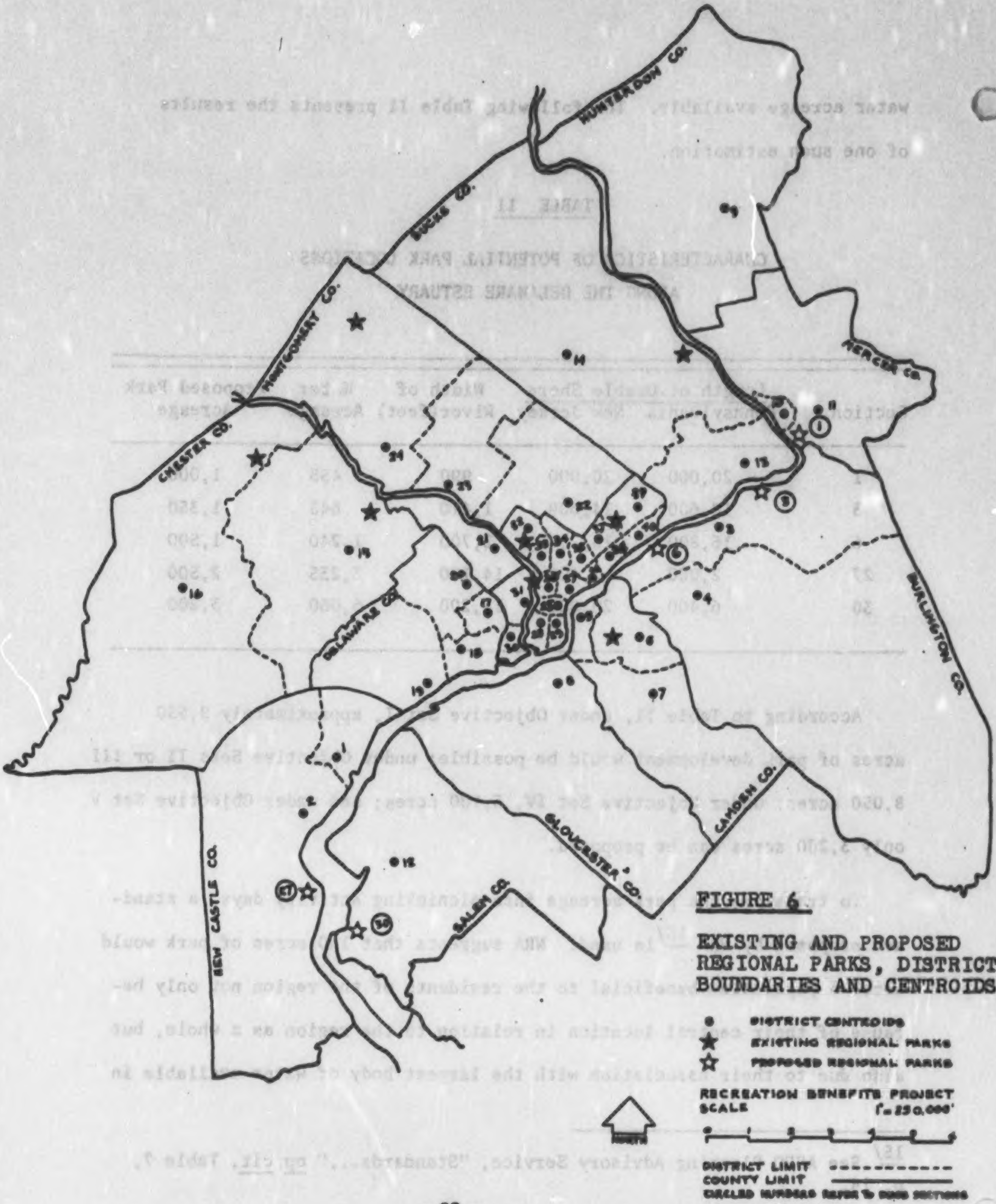

HUNTERDON CO.
BUCKS CO.
MONTGOMERY CO.
CHESTER CO.
MERCER CO.
BURLINGTON CO.
DELAWARE CO.
CAMDEN CO.
GLOUCESTER CO.
SALEM CO.
NEW CASTLE CO.
NORTH
DISTRICT CENTROIDS
EXISTING REGIONAL PARKS
PROPOSED REGIONAL PARKS
RECREATION BENEFITS PROJECT
SCALE 1" = 250,000'
0 1 2 3 4 5 6
DISTRICT LIMIT
COUNTY LIMIT
CIRCLED NUMBERS REFER TO SHORE SECTIONS

FIGURE 6

EXISTING AND PROPOSED REGIONAL PARKS, DISTRICT BOUNDARIES AND CENTROIDS

the area and the fact that these parks would offer a significant portion of the diversified parkage of recreational facilities which the region extensively needs.

Operationally, a simple examination of the estuary maps showing the potential location of the outdoor recreation facilities for each of the alternative river development plans (Objective Sets) can easily reveal the possibility of selecting several potential locations for park development along the river. These potential locations are the ones which correspond to the areas where water-contact recreation will be permissible. Proximity to urbanized areas and spacing between parks may also be used as supplementary factors in spacing the facilities. Such an examination of the proposed plans reveals that for Objective Set I, five such parks can be identified at sections 1, 3, 6, 27, and 30 of the estuary; for Objective Sets II and III, four of these same parks could be developed (except that at section 6) ; two parks at sections 27 and 30 can be proposed for Objective Set IV, while for Objective Set V, only one park at section 30 can be seen as possible. Figure 6 indicates the actual location of these potential parks and picnic areas along the Delaware River.

Examination of the characteristics of the proposed park locations can assist in estimating the number of acres that could be developed in each location. This can be done for each section through the study and consideration of the 50,000, or about 39,000 persons 12 years and over. For a 1960 participation rate of 2.81 activity days per person 12 years and over, 100 acres would generate about 110,000 activity days, or 1,100 picnicking activity days per acre. For 1976 and 2000, with the projected rates of 3.21 and 3.59 activity days per person 12 years and over, an estimate of 1,250 and 1,400 picnicking activity days per acre of park development is found. Table 12 presents these results.

TABLE 12

PARTICIPATION IN PICNICKING IN MILLIONS OF ACTIVITY DAYS BY OBJECTIVE SET

O.S.	Millions of Activity Days	
	1976	2000
I	12.94	14.49
II	11.06	12.39
III	11.06	12.39
IV	7.13	7.98
V	4.00	4.48

The Mean Park Distance Approach

The concept of mean park distance has been presented earlier in Chapter V of the report on Phase I. It can be recalled here that this concept related the percentage of the population in a metropolitan region visiting all the parks in the region with the average distance between the parks and the potential park users.

In this section we shall apply this concept of mean park distance to the Delaware Estuary study area. Because of the overall region similarities between our study area and the Detroit one, the relationships presented in Chapter V, based on the Detroit data, will be retained. Furthermore it can soon be seen that our concern will only be with the most stable portion of the empirical curves. However, since the Detroit curves were based on the availability of only eight regional parks it, therefore, shall be necessary to adjust (raise) these curves proportionately to the number of parks that would be available in our region. Figure 7 presents the Detroit curves and the required proportional adjustments.

For estimating purposes, it is necessary to identify the number of regional parks that are or will be available in our study area in 1960, 1976, and 2000. For 1960, eight parks of regional significance could be identified. The selection is based on a number of characteristics of regional parks that include size (total water and picnic acreage), use (variety of activities, such as boating and fishing), and high rates of visitation. These parks are listed below in Table 13.

TABLE 13

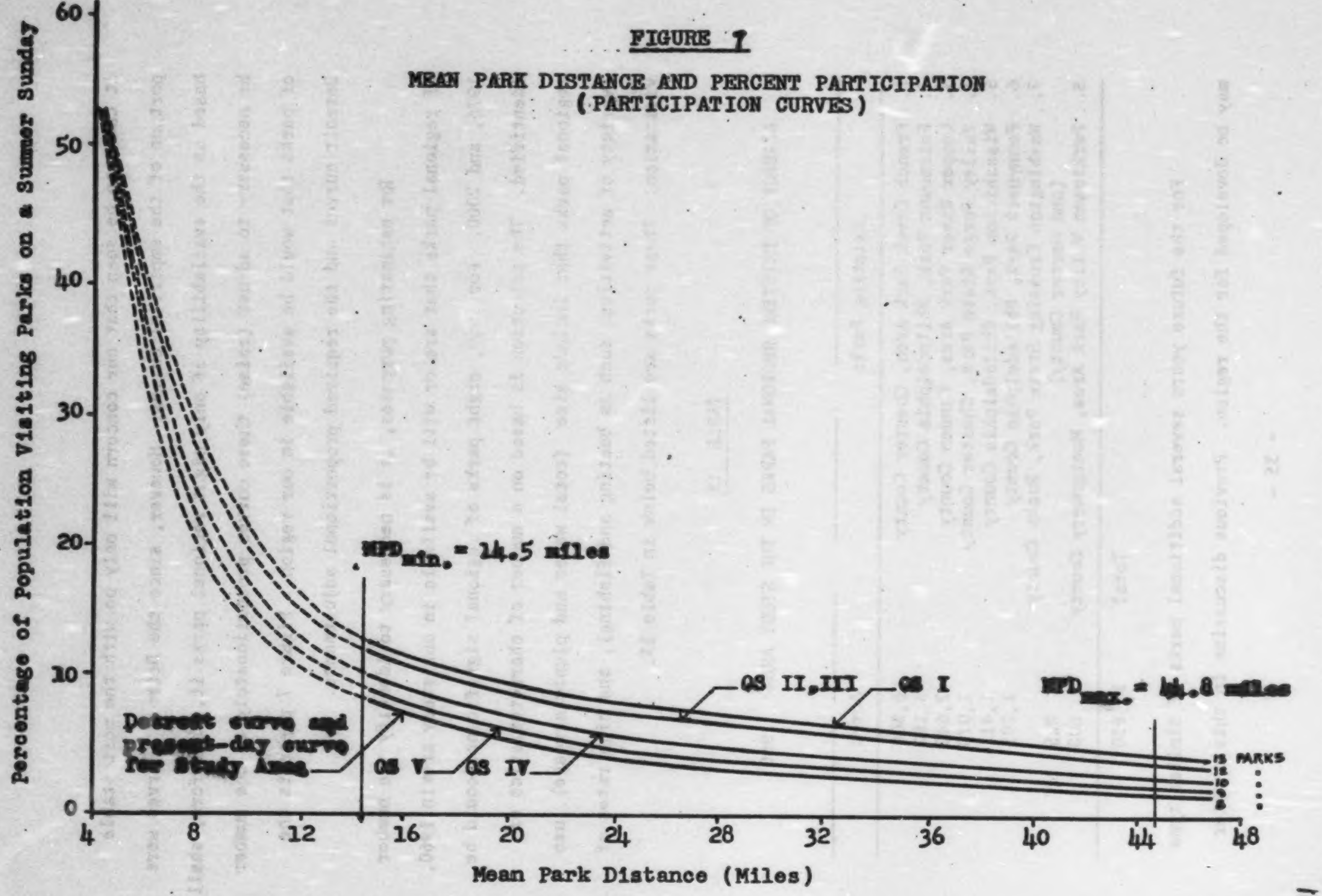
ACREAGE OF EXISTING REGIONAL PARKS IN THE STUDY AREA: 1960

Existing Parks	Acres
1. French Creek Park Area, Chester County	6,500
2. Fairmount Park, Philadelphia County	3,187
3. Cooper River Park Area, Camden County	2,642
4. Valley Forge State Park, Chester County	2,070
5. Wissahickon Park, Philadelphia County	1,411
6. Pennypack Park, Philadelphia County	1,295
7. Washington Crossing State Park, Bucks County (and Mercer County)	925
8. Perkiomen Valley Park Area, Montgomery County	600
Total	18,630

For the future years several additional parks of similar type may be developed for the region. Previous discussion in this chapter

FIGURE 7

MEAN PARK DISTANCE AND PERCENT PARTICIPATION
(PARTICIPATION CURVES)



belabored the possible locations of regional parks in the future under alternative levels of improvements of the water quality of the Delaware River. Accordingly, Figure 6, presented earlier, indicates the potential location of each of these possible future regional parks, and specifies their general geographic location and centroid.

The study area may also be divided into several planning analysis units, or districts, and the centroid of each district can be identified for analytical purposes. Forty such planning units are defined. The delineation of these districts based on an attempt to have for 1960 an equal distribution of population in each district and an effort to match them with municipal and other civil sub-division boundaries. Figure 6 also shows the exact delineation of these planning units. The centroids of each district are chosen at the points of population concentrations. Finally, the population distribution by district is then projected for the years 1976 and 2000 taking into account the proximity of the districts to areas of high rates of growth and the total county projections for these years. Table 14 shows the future projections of population by district, as well as the county and region totals.

The distances from the centroid of each district to the centroids of each of the regional parks are measured in miles, and their averages are estimated accordingly. Separate estimations are made for each of the five alternative plans which correspond to the five Objective Sets of river development. The number of parks varied in each case as follows: O.S. V, 8 parks; O.S. IV, 9 parks; O.S. III, 10 parks, O.S. II, 12 parks; and O.S. I, 13 parks.

TABLE 14

TOTAL POPULATION IN 1960, 1976, and 2000 BY PLANNING UNITS, COUNTIES, AND THE STUDY AREA

State	County	Units		Population (000)					
				1960		1976		2000	
Dela-ware	New Castle	2	1	156		223		325	
			2	152	308	197	420	265	590
New Jersey	Burlington	2	3	113		104		279	
			4	112	225	100	344	223	502
	Camden	3	5	133		168		220	
			6	139		170		215	
			7	120	392	142	480	174	609
	Gloucester	1	8	135	135	189	189	271	271
	Hunterdon	1	9	54	54	65	6565	82	82
	Mercer	2	10	141		176		229	
			11	126	267	144	320	173	402
	Salem	1	12	59	59	72	72	92	92
Pennsylvania	Bucks	2	13	168		341		599	
			14	141	309	256	597	428	1,027
	Chester	2	15	109		146		199	
			16	102	211	126	272	162	361
	Delaware	4	17	132		191		278	
			18	134		185		260	
			19	130		177		247	
			20	156	552	195	748	253	1,038
	Montgomery	4	21	146		207		286	
			22	129		182		250	
			23	135		104		247	
			24	107	517	147	720	199	982
	Philadelphia	16	25	125		135		159	
			⋮	⋮		⋮		⋮	
			40	125	2,003	135	2,161	159	2,546
	Total	40			5,032		6,388		8,502

Source: Regional and county projections from the Delaware Valley Regional Planning Comm.

The mean park distance for each planning unit in the five cases ranges from 14.5 to 44.8 airline miles as Table 15 indicates. Within that range the curve relating the percentage of park users to the MPD on a summer-Sunday is most stable, as Figure 7 shows.

TABLE 15

RANGE OF MEAN PARK DISTANCE IN THE FORTY PLANNING UNITS IN THE STUDY AREA BY OBJECTIVE SET

O.S.	Number of Parks	Estimated Minimum MPD For a Planning Unit	Estimated Maximum MPD For a Planning Unit
I	13	19.6	40.9
II, III	12	20.4	41.5
IV	10	19.6	44.8
V	9	17.6	41.3
Present	8 (no additional parks along the river)	14.5	39.5

Figure 7, presented earlier, clearly indicates what portion of the participation curves is covered by the minimum-maximum ranges shown in Table 15. In all projection curves this portion is the least fluctuating and, therefore, the most reliable.

Using the participation curves presented in Figure 7, a projection can be made of the percentage of the population of each district that would visit any of the available regional parks in the study area. Converting these percentages into absolute numbers of park users through the use of the population projections by district, one then may estimate the number of regional park users can be converted into needed regional park acreage. The results of a set of such calculations are shown in Table 16. The same table includes also an estimation of the overall mean park distance of the study area (the arithmetic mean of the mean park distances of the planning units), which is indicative of the areal distribution of the parks in relation to the population in the region.

TABLE 16

OVERALL MEAN PARK DISTANCE AND NEEDED REGIONAL PARK ACREAGE IN THE STUDY AREA BY OBJECTIVE SET

O.S.	Number of Parks	1960		1976		2000	
		Acres	MPD	Acres	MPD	ACRES	MPD
II	13	-	-	40,800	23.5	53,500	23.8
II,III	12	-	-	36,650	24.0	47,830	24.4
IV	10	-	-	30,460	23.9	39,920	24.0
V	9	-	-	31,020	21.7	40,600	21.9
Present	8	26,600	19.4	33,010	19.7	43,090	20.0

An analysis of the percentage of the population visiting the regional parks from each planning unit in each of the alternative plans reveals that it varies from 4.5 percent to 6.5 percent of the total population of the study area as the population and number of parks increased. Examining in some detail the results presented in Table 16, one may see that even in 1960, with eight regional parks totaling 18,630 acres available, there can be defined a deficit of 7,970 acres of regional parkland. Retaining only those eight parks in the year 1976 and in the year 2000, but with the expected increase in population for the region, the deficit would increase to 14,380 and 24,460 acres respectively. All these estimations are based, of course, on the conservative measure of 10 acres per 100 park users.

Such an examination of the results of Table 16 leaves hardly a doubt that in all cases discussed above (covering all five alternative river development plans), the future recreation demand that would have to be satisfied is indeed very high. Suffice it to say that under Objective Set I this demand would be equivalent to about 5 parks, each the size of Fairmount Park, in 1976; and 5 parks, each the size of French Creek Park, in the year 2000. Apparently the critical consideration in all plans is the capacity of the park areas which can realistically be expected to be developed along the banks of the river. The portion of the demand that will still remain unsatisfied will have to be met in locations outside the study area which will, hopefully, maintain the overall mean park distance in the park system of the region.

In the previous section of this chapter, the potential development of parks along the river banks for each of the five Objective Sets has been discussed. A comparison between the acreage and the capacities of these potential parks and the total acreage of the projected demand for outdoor regional recreation facilities would reveal that portion of the projected demand that could be satisfied by these potential future parks and the remaining demand which would have to be accommodated by other means. Table 17 shows this comparison.

TABLE 17

UNMET DEMAND (PARK ACRES) BY OBJECTIVE SET

Using 10 acres per 100 users and MPD to estimate average summer-Sunday park users

O.S.	Acreage of Potential Future Parks Along River	Acreage That Would Still Be Required To Meet Projected Outdoor Recreation Demand For Study Area In: 1976	2000
I	9,550	22,170	34,870
II,III	8,050	18,020	29,200
IV	5,700	11,830	21,920
V	3,200	12,390	21,970

The development of the proposed parks along the river would, necessarily, be subject to a staging plan. They could progressively be increased both in number and in acreage. The determining factors would include the relative ease with which land could be acquired along the river, as well as the costs involved.

Conclusion

The use of the mean park distance approach enables the analyst to determine the future demand for regional parks in our study area, and to assess the locational advantage that results from alternative distributions of regional parks within the study area. In the context of this project these alternatives correspond to the DECS alternative levels of water quality improvement of the Delaware River by section. Furthermore, the analyst becomes able also to estimate that portion of the demand that would remain unsatisfied in each case, and that would have to be met in locations other than the ones along the river within the study area.

In all cases discussed above, it has been shown that the determining factor is the potentiality and the capacity of the river for park development. Obviously, the total demand is by far greater than the possible capacity which can, potentially, be developed through each of the alternative river development plans. The next step is to translate the findings of the previous chapters concerning the aggregate demand in activity days that the improvement of the river's waters makes possible into some measure of quantifiable benefits. This will be the task of the following chapter.

CHAPTER IV

PROJECTION OF MONETARY RECREATION BENEFITS

The concept of "benefits" in the context of outdoor recreation activities is very elusive. Several major questions are associated with such a concept. At the outset, for instance, a unit of measurement is required to express those benefits. Moreover, some means of evaluating the impact and the extent of the intangible aspects and considerations in recreation is needed. For the purpose of this study, however, some simplified and conservative standards recommended by previous major studies as well as by the Bureau of Outdoor Recreation, [16] can be put to use, perhaps with some minor modifications.

In general it is suggested that outdoor recreation be specified in more detail in terms of individual recreation activities. Two types of such activities are usually pertinent, i.e., general and specialized activities. General activities are usually those attracting a majority of participants and include swimming, pier and party-boat fishing, motor boating, sailing, and canoeing. Specialized activities are those which involve limited opportunities, low intensity of use, and a sizeable personal expenditure by the participant. These, in turn, include fishing by those anglers interested primarily in certain species of trophy fish and certain local preferences, long-range cruises, and the like. It is rather clear, therefore, that the present project involves mainly general outdoor recreation activities, an equivalent unit of pecuniary evaluation of an "activity day," as defined earlier in this report, has been proposed frequently and used in recreation studies. This equivalent unit usually varies from $0.50 to $1.50 per activity day. The choice of a benefit figure within this range usually depends on the nature of the visit and the extent of use of the facility. If such a facility induces only casual visitation, the lower end of the scale ($0.50) is usually used. Higher values would be assignable where the facilities provide diversified opportunities. In cases where the number of activities is limited, but the facilities are unusually well developed, still higher values of the scale may be accepted. In addition, consideration might be given to the expected degree of success of a project, its general attractiveness, topography, microclimatic conditions, and the uniqueness of experience. The general abundance of a certain facility is another factor usually taken into account. If a region is relatively well served by different swimming facilities, for example, the the relative importance in terms of a unit value would be lowered.

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[16] "Evaluation Standards for Primary Outdoor Recreation Benefits," Bureau of Outdoor Recreation,Memorandum No. 64-8, Supplement No. 1, Ad Hoc, Water Resources Council, Washington, D. C., June 4, 1964.

The quantification of benefits on the basis of the above monetary equivalents and the limited number of outdoor recreation activities is more or less readily identifiable and measurable. In measuring the benefits of a certain facility, however, several intangible components must be considered as well. The literature is very meager in terms of suggestions as to the translation of these benefits into monetary units even though their importance is generally recognized. Similarly, great difficulties were encountered in the present project when the intangible and variable components of outdoor recreation benefits were attempted to be specifically included. Such benefits were therefore omitted from the final estimations although their pertinence and significance were clearly recognized. It is clear and generally accepted that the affixing of monetary benefits to recreation facilities in our study region, or for that matter any other region, is a difficult process. The measures are crude and the intangibles may be numerous. Clearly, additional research outside the range of this study is needed to assess the value of intangible benefits. Research on the measurement and quantification of outdoor recreation benefits could proceed within the framework of value theory and through the conduct of experimental design procedures over a long period of time. In any case, at present, the suggestion and, perhaps, acceptance of the appropriate or most reasonable measures of tangible or clearly perceived, outdoor recreation benefits is left up to the value judgments of responsible researchers. For the present study the first step towards such measurement of benefits is the acceptance of a range of unit value measures for each water-oriented activity and under each Objective Set. Thus the aggregate benefits would also be presented within a range of minimum and maximum monetary values. Unique values proposed or supported by individuals should or would be anywhere within that range, depending on the subjective considerations of each individual.

Projection of Swimming Benefits

For the purpose of translating into monetary units the benefits which may be derived from swimming participation in our study area in 1976 and 2000 from alternative plans of river development, a minimum equivalent benefit rate of $0.75 per activity day and a maximum of $1.25 per activity day have been accepted as reasonable and, in the main, representative of the value people in the region place on such activities. The results of the calculations for each Objective Set are shown in Table 18.

TABLE 18

SWIMMING BENEFITS BY OBJECTIVE SET

O.S.	Activity Days (1,000,000)		Recreation Benefits ($1,000,000)		Range
	1976	2000	1976	2000	
I	3.9	18.0	2.9	13.5	Min.
			4.9	22.5	Max.
II	3.9	18.0	2.9	13.5	Min.
			4.9	22.5	Max.
III	3.9	18.0	2.9	13.5	Min.
			4.9	22.5	Max.
IV	3.9	8.25	2.9	6.2	Min.
			4.9	10.3	Max.
V	3.9	3.96	2.9	3.0	Min.
			4.9	5.0	Max.

Source: Swimming Activity Days from Column E, Table 4 above.

According to the findings included in Table 18, the greatest amount of monetary benefits derivable from swimming activity would be between 2.9 and 4.9 million dollars in 1976 regardless of which Objective

Set is followed. For the year 2000, equal benefits would be derivable from either Objective Sets I, II, or III, and can be estimated as being between 13, 5, and 22.5 million dollars. Under Objective Sets IV or V, swimming benefits in the year 2000 will be much lower, ranging from 6.2 to 10.3 million dollars under Objective Set IV, and 3.0 to 5.0 million dollars under Objective Set V. The reason for these findings is that the expected high rate of swimming demand would tend to be satisfied primarily by facilities other than the Delaware River as previous discussion has already pointed out (Table 4, page 16 above). In terms of swimming benefits, therefore, there is limited value to be gained from pursuing Objective Sets I or II. Objective Set III is most beneficial in the long run (2000). If only the short run (1976) is taken into consideration, Objective Set V would be able to meet the demand for swimming activities by maintaining the quality of the river's waters as it is at the present time. The superiority of Objective Set III can, of course, be seen when the long range benefits are taken into account.

Projection of Boating Benefits

It should be recalled that in Chapter II the total boating demand was divided into activities which include one or more of the following: pleasure boating, fishing, and swimming. Different rates of equivalent dollar benefits (and also different ranges) and reasonably attached to boating activities depending on whether they involve one, two, or all three of those activities associated with boating recreation. Thus, where it would be possible to participate in the three sub-activities together, a maximum benefit rate of $5.00 per activity day and a minimum benefit rate of $3.00 per activity day were attached to 25% of the total number of activity days. To the remaining 75% of the activity days in the same river areas, a maximum rate of $1.25 and a minimum rate of $0.75 per activity day were used. [17] For the two other categories, i.e., where only pleasure boating and fishing, or solely pleasure boating is possible, a rate of $0.75 per activity day was accepted as representative of the dollar value of the derivable benefits. The following Table 19 presents the results of the breakdown of the total number of activity days for each of the five Objective Sets in terms of the three cases of derivable benefits. As can be seen from Table 19, the number of activity days, on the basis of which the dollar value of benefits are derived, is the same for 1976 and 2000. The reason is that in both cases the river is expected to be used to full capacity well before 1976, and that the demand for boating facilities that will have to be satisfied by the river or otherwise will be far greater than the capacity of the river under any Objective Set and in both projection years.

It is clear from the table that Objective Set I is the most productive alternative in terms of boating. This is again a reflection of the expected full use of any amount of water the river can make available for boating; a clear case where demand far exceeds supply. A gradual decrease of boating benefits can also be seen as the Objective Sets move from

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[17] This division of equivalent monetary benefits of the total activity days in those areas where all three associated activities of boating are possible is due to the expectation that in these areas only about one-fourth of the total number of boaters will make actual and full use of the facility, thus deriving the full possible benefits there.

O.S. I to O.S. V, the alternative with the minimum derivable benefits.

TABLE 19

BOATING BENEFITS BY OBJECTIVE SET

O.S.	Millions of Activity Days			Benefits ($1,000,000) Derived From:					Total Benefit ($1,000,000)	
	B1+B2	25%B3	75%B3	B1+B2	25%B3		75%B3			
					Min.	Max.	Min.	Max.	Min.	Max.
I	0.7	0.8	2.5	0.525	2.4	4.0	1.875	3.125	4.80	7.65
II	0.8	0.6	1.9	0.600	1.8	3.0	1.425	2.375	3.83	5.98
III	0.4	0.6	1.9	0.300	1.8	3.0	1.425	2.375	3.53	5.68
IV	0.4	0.5	1.7	0.300	1.5	2.0	1.275	2.125	3.08	4.43
V	0.7	0.2	0.5	0.525	0.6	1.0	0.375	0.625	1.50	2.15

Source: Total boating activity days from Column E, Table 6 above. Breakdown of boating sub-activities from Table 5, above.

Projection of Fishing Benefits

In estimating the monetary equivalent of the benefits derivable from participation in fishing activities, up to 25 percent of fishing activity days are expected to be specialized activity days and, therefore, correspond to a monetary equivalent rate of benefits ranging from $3.00 to $5.00 per activity day. The remaining activity days would be typical recreation activity and amateur activity corresponding to what was earlier defined as "general" activity and, therefore, correspond to a monetary equivalent rate of $0.75 to $1.25 per activity day.

As noted in the case of benefits from boating, the number of effective activity days for fishing activity in the projection years 1976 and 2000 is identical under each objective set. In each case, the river will be used to capacity well before 1976, since the demand for fishing opportunities is expected to be much higher than the total supply of appropriate facilities. The results of estimating the monetary equivalent of the benefits from fishing are shown in Table 20. The calculations are made on the basis of the previously presented ranges of maximum and minimum equivalent rates and for each of the five Objective Sets.

TABLE 20

FISHING BENEFITS BY OBJECTIVE SET

O.S.	Activity Days (1,000,000) 25% of total AD	Activity Days (1,000,000) 75% of total AD	Benefits ($1,000,000) Derived From: 25% of total AD Min.	Benefits ($1,000,000) Derived From: 25% of total AD Max.	Benefits ($1,000,000) Derived From: 75% of total AD Min.	Benefits ($1,000,000) Derived From: 75% of total AD Max.	Total Benefits ($1,000,000) Min.	Total Benefits ($1,000,000) Max.
I	0.29	0.88	0.87	1.45	1.66	1.10	1.53	2.55
II	0.17	0.51	0.51	0.85	0.38	0.64	0.89	1.49
III	0.17	0.51	0.51	0.85	0.38	0.64	0.89	1.49
IV	0.10	0.30	0.30	0.50	0.23	0.38	0.53	0.85
V	0.10	0.29	0.30	0.50	0.22	0.36	0.52	0.86

Source: Total fishing activity days from Column E, Table 8 above.

Paralleling the findings observed for boating, the table shows that when sport fishing alone is considered, Objective Set I is the most productive. Objective Sets II and III have the same fishing capacities as do Objective Sets IV and V, but at a lower level.

Paralleling the findings observed for boating, the table shows that when sport fishing alone is considered, Objective Set I is the most productive. Objective Sets II and III have the same fishing capacities as do Objective Sets IV and V, but at a lower level.

Projection of Benefits from Picnicking

Picnic recreation activities represent essentially a combination of what was earlier defined "general" and "specialized" recreation activities. Their association with water facilities increases their attractiveness and the number of required provisions for full enjoyment of the facilities. In fact, several additional factors could be considered in our particular case which would justifiably place the picnic facilities along the river within the region in a particularly advantageous and attractive position. For this reason the monetary equivalent of an activity day in picnicking should correspond to a value between the $0.75 accepted for the "general" recreation activities and $3.00 and $5.00 accepted for "specialized" activities such as boating and sport fishing. The monetary equivalent in translating picnic benefits into monetary values can, however, again be considered within a limited range. Such reasonable and representative range was accepted to be one using $1.00 as minimum and $1.50 as maximum value per activity day. Utilizing the previously estimated activity days by Objective Set, and the above-stated range of monetary equivalent benefits, one may estimate the equivalent monetary benefits for each Objective Set and for each projection year. Table 21 presents the results of these calculations.

Observing the results presented in Table 21, it becomes apparent that the largest amount of recreation benefits from picnic activities is produced by Objective Set I. No criteria are available to differentiate between Objective Sets II and III; each produces the same amount of activity days and their equivalent monetary benefits. Objective Sets IV and V come at the end of the range.

TABLE 21

PICNICKING BENEFITS BY OBJECTIVE SET

O.S.	Activity Days (1,000,000)		Benefits ($1,000,000)		Range
	1976	2000	1976	2000	
I	12.94	14.49	12.94	14.49	Minimum
			19.41	21.74	Maximum
II	11.06	12.39	11.06	12.39	Mimimum
			16.59	18.59	Maximum
III	11.06	12.39	11.06	12.39	Minimum
			16.59	18.59	Maximum
IV	7.13	7.98	7.13	7.98	Mimimum
			10.65	11.97	Maximum
V	4.00	4.48	4.00	4.48	Minimum
			6.00	6.72	Maximum

Source: Total Picnicking Activity Days from Table 12 above.

Aggregation of Recreation Benefits

A summary of the recreation benefits and their equivalent monetary value is presented in Table 22 for the four outdoor recreation activities

TABLE 22

TOTAL RECREATION BENEFITS IN 1976 AND 2000
BY OBJECTIVE SET

O.S.	Range	Recreation Benefits ($1,000,000)											
		Swimming		Boating		Fishing		Picnicking		Total Benefits		Net Benefits	
		1976	2000	1976	2000	1976	2000	1976	2000	1976	2000	1976	2000
I	Min.	2.9	13.5	4.80	4.80	1.53	1.53	11.94	14.49	22.17	34.32	13.25	24.82
	Max.	4.9	22.5	7.65	7.65	2.55	2.55	19.41	21.74	34.51	54.44	20.60	39.71
II	Min.	2.9	13.5	3.83	3.83	0.89	0.89	11.06	12.39	18.68	30.61	9.76	21.11
	Max.	4.9	22.5	5.98	5.98	1.49	1.49	16.59	18.59	28.96	48.56	15.05	33.83
III	Min.	2.9	13.5	3.53	3.53	0.89	0.89	11.06	12.39	18.38	30.31	9.46	20.81
	Max.	4.9	22.5	5.68	5.68	1.49	1.49	16.59	18.59	28.66	48.26	14.75	33.53
IV	Min.	2.9	6.2	3.08	3.08	0.53	0.53	7.13	7.98	13.64	17.79	4.72	8.29
	Max.	4.9	10.3	4.43	4.43	0.88	0.88	10.65	11.97	20.86	28.58	6.95	12.85
V	Min.	2.9	3.0	1.50	1.50	0.52	0.52	4.00	4.48	8.92	9.50	0.00	0.00
	Max.	4.9	5.0	2.15	2.15	0.86	0.86	6.00	6.72	13.91	14.73	0.00	0.00

Source: Tables 18, 19, 20, and 21.

which were pursued throughout this study. This table presents total benefits for each of the five alternative plans (Objective Sets) as well as the "net" benefits for each of the four incremental Objective Sets. By definition, net benefits for 1976 and 2000 are those for each incremental Objective Set over and above the ones which would be derived under Objective Set V (present conditions maintained).

Observing the results reported in Table 22, it becomes evident that the minimum benefits are the ones derivable from Objective Set V. According to the low value of equivalent monetary rates, these benefits correspond to only 8.92 and 9.50 million for the years 1976 and 2000 respectively. For the purpose of comparing the other four Objective Sets, one may use the net benefits estimates appearing in the last two columns of Table 22. Furthermore, by using an average value between the minimum and maximum monetary estimates, one may reach a more sound and representative comparative measure. The results of such an estimation are shown in Table 23.

TABLE 23

AVERAGE NET BENEFITS FOR
SWIMMING, BOATING, FISHING, AND PICNICKING
BY OBJECTIVE SET

O.S.	Average Net Benefits ($1,000,000) 1976	2000
I	16.9	32.3
II	12.4	27.5
III	12.1	27.2
IV	5.8	10.6

Source: Table 22.

Observing these average estimates, an analyst can easily conclude that Objective Set I represents the most productive alternative plan. Objective Sets II and III are evidently also highly productive in terms of outdoor recreation benefits, especially when viewed in the long run, in which case the net benefits from both alternative plans are close to whose which would be derived from Objective Set I. Objective Set IV appears to be less beneficial than I, II, or III while, of course, Objective Set V (involving no improvements) is the least productive alternative plan, always in terms of the four major recreation activities which were intensively examined in this study. In general, it appears that Objective Set III is the most promising one because, in addition to being almost as productive as Objective Set II, it might be less costly. Of course, considerations of intangible benefits should also be taken into account and may prove helpful in making a final recommendation as to which alternative is to be pursued.

CHAPTER V

SUMMARY AND CONCLUSIONS

From the report on Phase I of this research effort, it may have become evident that it is extremely difficult to project recreation benefits in view of the probable changes in tastes, in the trend in providing private recreation facilities, and in reaching further out from a region for recreation purposes, as the means of travel continuously increase.

Recreation benefits can come from direct and indirect participation in well-defined or highly-personalized recreation activities. For the purposes of the present study, the projection of recreation benefits on the basis of well-defined, and broadly appreciated outdoor recreation activities was considered appropriate. These activities were sport fishing, swimming, boating and picnicking.

Monetary equivalents of the benefits from increased participation in each recreation activity were determined by accepting a reasonable and widely supported rate of dollar value for each activity day. Where a variation of such rate is considered more realistic and representative, a range of unit benefit with reasonable minimum and maximum values was accepted. The definition of an activity day was identical to the one proposed in the ORRRC studies.

In calculating future activity days and monetary benefits for each alternative plan (Objective Set), proper consideration ought to be given to plans and expectations of use of other similar facilities anticipated within the study area. Similarly, serious considerations ought to be given to plans and expectations of use of other similar facilities anticipated within the study area. Similarly, serious considerations ought to be given to existing and future facilities in the vicinity of the study area. River benefits were to be estimated only in conjunction with these other expectations. The projection process presented in Chapter III of Phase I clearly presents the philosophy and the approach to these projections.

In most cases the future capacity of the potential river facilities proved to be the most important factor in estimating recreation benefits than any other single factor. This was so because demand projections made it apparent that future demand for the four outdoor recreation activities under consideration far exceed the potential capacity of the river and the other planned facilities within the region.

There is clearly a gradation of benefits as we move from O.S. I to O.S. V. Although this project cannot conclude as to which one of the Objective Sets is preferable, it appears that the debate is bound to center between O.S. II and O.S. III. These two Objective Sets produce quite similar recreation benefits,and, therefore, it would be upon the cost requirements of each Objective Set, as well as other indirect considerations, that the selection may have to rest. O.S. IV and O.S. V are markedly inferior and could be considered as appropriate for consideration only in cases where major compromises in region's objectives are externally imposed upon the region.

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